THE REVIEW

OF

APPLIED MYCOLOGY

Vol. XXIV

ISSUED BY THE IMPERIAL
MYCOLOGICAL INSTITUTE

THE IMPERIAL MYCOLOGICAL INSTITUTE
KEW, SURREY

1946

All Rights Reserved

IMPERIAL MYCOLOGICAL INSTITUTE

EXECUTIVE COUNCIL

Lieut.-Col. J. G. Robertson, Canada

Sir Patrick R. Laird, C.B., F.R.S.E., United Kingdom

F. L. McDougall, C.M.G., Australia

A. P. Van der Post, South Africa

J. W. Dulanty, C.B., C.B.E., Eire

M. K. Vellodi, C.I.E., I.C.S., India

B. O. Binns, O.B.E., I.C.S., Burma

T. G. Gisborne, Southern Rhodesia

C. Y. Carstairs, Colonies, Protectorates, and Mandated Territories

Secretary: Sir Herbert Howard.

STAFF

Director and Editor
S. P. Wiltshire, M.A., D.Sc.

Assistant Director and Sub-Editor
H. A. Dade, A.R.C.S.

Mycologist
E. W. Mason, M.A., M.Sc.

Senior Assistant Mycologist
G. R. Bisby, Ph.D.

Sub-Editor
Grace M. Waterhouse, M.Sc.

Assistant Mycologists
S. J. Hughes, M.Sc.
M. B. Ellis, B.Sc.

PRINTED IN GREAT BRITAIN AT THE UNIVERSITY PRESS, OXFORD
BY CHARLES BATEY, PRINTER TO THE UNIVERSITY

ERRATA

VOLUME XXIII

page 125 line 42 for 'centipedes' read 'woodlice'
536 6 ,, ,, ,, ,,

VOLUME XXIV

4 44 for '*Euthania*' read '*Euthamia*'
49 31 for 'tomato' read 'eggplant'
99 10 and 11 for '*Corticium koleroga*: *R.A.M.*, xviii, p. 451' read '*Phytophthora arecae*: *R.A.M.*, xix, p. 258'
122 40 for '*Launia*' read '*Launaea*'
193 23 for '*oxycanthae*' read '*oxyacanthae*'
206 47 for '*Muhlenbergia*' read '*Muehlenbergia*'
207 31 for '*Dydercus*' read '*Dysdercus*'
224 46 for '*Ustilago*' read '*Urocystis*'
244 47 for '*reflexus*' read '*retroflexus*'
259 40 for 'cauliflower mosaic virus [' read '[cauliflower mosaic virus:'
262 25 for 'sulphur' read 'sulphate'
265 42 for '*claviceps*' read '*clavipes*'
269 2 for '*kolleri*' read '*avenae*'
278 45 for '*Kloekera*' read '*Klockeria*'
288 41 for '*Hyoscymus*' read '*Hyoscyamus*'
330 22 for '*murarum*' read '*murorum*'
349 19 for 'blackspot' read 'blackleg'
353 21 for 'properly' read 'probably'
355 18 for '*ricini*' read '*ricinella*'
358 5 for 'R. R. Midgley' read 'A. R. Midgley'
for 'D. E. Dunkless' read 'D. E. Dunklee'
370 8 for '*Thaneda*' read '*Themeda*'
393 16 for '*R*' read '*T*'
405 45 for 'phenylalamine' read 'phenylalanine'
407 43 insert '[*R.A.M.*, ix, p. 580; x, p. 646; xxi, p. 372]' after 'winter wheat'
464 29 for 'Busby' read 'Bisby'
472 34 for 'Crandall (B. E.)' read 'Crandall (B. S.)'
488 42 for '*Pachyrrhizus*' read '*Pachyrhizus*'
520 18 for '*magninerva*' read '*magnivena*'
544 ,, ,, ,, ,,

Digitized by the Internet Archive
in 2025

https://archive.org/details/review-of-plant-pathology_1945-01_24_1

IMPERIAL MYCOLOGICAL INSTITUTE

REVIEW
OF
APPLIED MYCOLOGY

VOL. XXIV JANUARY 1945

DILLON WESTON (W. A. R.). **Chocolate spot of Beans.**—*J. Minist. Agric.*, li, 7, pp. 325–326, 1 chart, 1944.

This is a popular account of recent work on bean chocolate spot (*Botrytis cinerea*) [*R.A.M.*, xxiii, p. 467] illustrated by means of a chart.

SNYDER (W. C.). **Smudge and other fungus blemishes on Onion sets imported into California.**—*Plant Dis. Reptr*, xxvii, 23, pp. 645–647, 1943. [Mimeographed.]

Under the terms of a quarantine operating against onion smudge (*Colletotrichum circinans*) [*R.A.M.*, xxiii, p. 470] in California, a number of the carloads of sets imported annually into the State for autumn planting are rejected at their destination. However, the microscopic examination of samples from eight such consignments revealed *C. circinans* on the bulb scales of only one set of one lot of white onions, though the fungus was present in very small lesions on weathered tips of the necks of several sets in all but two lots. Symptoms simulating those of smudge were present on a number of sets from all carloads, among the fungi implicated being species of *Aspergillus*, *Macrosporium*, *Cladosporium*, *Phoma*, and *Botrytis*. It is thus apparent that the diagnosis of smudge in onion sets from other States is attended by considerable difficulty, especially in the case of brown specimens which have lost their dried tips in handling, this being the only site susceptible to infection in the coloured varieties [ibid., iii, p. 118]. The absence of smudge on California-grown onions may be due either to the efficiency of the quarantine or to the inability of the pathogen to become acclimatized to local conditions.

PORTER (R. P.). **'Arasan' (thiosan) as a Spinach seed treatment.**—*Plant Dis. Reptr*, xxvii, 14, pp. 262–263, 1943. [Mimeographed.]

After stating that arasan is identical with thiosan as regards amount and identity of the active ingredient, i.e., 50 per cent. tetramethylthiuram disulphide, and that both are equally effective as seed treatments, the author describes comparative tests conducted in the greenhouse in which spinach seed treated with zinc oxide 2 per cent., thiosan 0·4 per cent., arasan 0·4 per cent., and untreated seed was planted in soils inoculated with *Pythium* sp. or *Rhizoctonia* sp. In the *Pythium*-infected soil zinc oxide gave 27·3, 12, 73·2, and 38·5 per cent. mean emergence, thiosan 28·3, 24·2, 75·7, and 43·7 per cent., arasan (last two tests only) 76 and 49·5 per cent., and the untreated controls 3·7, 5, 52·7, and 24·5 per cent. In the *Rhizoctonia*-infected soil the corresponding figures were, for zinc oxide, 20·7, 13·5, 51·5, and 32·2 per cent., for thiosan 23·3, 23·2, 63·5, and 49·2 per cent., for arasan (last two tests only) 57·5 and 47 per cent., and for the untreated controls, 14, 8, 15·7, and 2·7 per cent.

The results so far received from co-operators in the National Spinach Seed Treatment Trials for 1943 indicate that a 0·25 per cent. dosage of arasan is adequate. In the nine significant tests so far received seven show arasan at 0·25 per cent. dosage to be as beneficial as zinc oxide at 2 per cent. The cost of treating

2,000 lb. spinach with zinc oxide (2 per cent.) plus graphite ranges from $9 to $12, as against $5.75 to $6.45 for arasan at 0·25 per cent. Arasan does not need graphite and contains no metal of which there is a scarcity owing to war conditions.

Shanor (L.). **Phytophthora megasperma root rot of Spinach in North Carolina.**—*Plant Dis. Reptr*, xxviii, 9, p. 351, 1944. [Mimeographed.]

Phytophthora megasperma was isolated in February, 1944, from spinach plants affected by root rot near Wilmington, North Carolina, an area in which the pathogen had not previously been recorded. The same host was also recently attacked for the first time by *P. megasperma* in California (*Plant Dis. Reptr*, xxviii, p. 320, 1944), where the fungus, however, has been known for some years past to infect crucifers under conditions favourable for its development.

Thompson (R. C.). **Lettuce varieties and culture.**—*Fmrs' Bull. U.S. Dep. Agric.* 1953, 38 pp., 15 figs., 1944.

In this bulletin on lettuce-growing in the United States (superseding *Bull.* 1609) [*R.A.M.*, xx, p. 242] notes are given on the symptoms, causes, and control of the principal diseases of this crop, including damping-off [loc. cit.], tipburn [ibid., xxii, p. 512], downy mildew (*Bremia lactucae*) [ibid., xxiii, p. 470], brown blight [ibid., xx, p. 242], drop (*Sclerotinia sclerotiorum* and *S. minor*) [cf. ibid., xix, p. 512; xxi, p. 440], bottom rot (*Rhizoctonia* [*Corticium*] *solani*) [ibid., xiv, p. 73], and aster yellows [ibid., xx, p. 337].

Gans (L.). **Die Sellerie-Blattfleckenkrankheit.** [The Celery leaf spot disease.]—*Gartenbauwirtsch.*, lviii, 15, 4 pp., 1941. [Abs. in *Z. PflKrankh.*, liii, 8–12, p. 302, 1943.]

The following simplified procedure for celery leaf spot (*Septoria apii*) control has been successfully practised by the author in Bavaria for a number of years: (1) seed-steeping in ceresan or abavit; (2) sterilization of seed-beds and permanent quarters with formalin; (3) postponement of sowing until early March to avoid growth disturbances; (4) dusting before and after transplanting with a copper-containing product, such as cusisa; (5) transplanting into well-prepared soil; (6) applying potash liberally and superphosphate and ammonium sulphate in moderate amounts to the prepared planting-out beds, followed at an early date by a top-dressing of nitrophoska and potash; (7) avoidance of over-watering; (8) immediate suppression of infection foci by two treatments with a copper dust; (9) removal of diseased refuse after harvesting. The Magdeburger Markt, Rheinischer Markt, and Oberdörfer varieties are comparatively resistant.

Preston (D. A.) & Ray (W. W.). **Yeast spot of Soybeans and Mung Beans caused by Nematospora coryli Peglion in Oklahoma.**—*Plant Dis. Reptr*, xxvii, 22, pp. 601–602, 1943. [Mimeographed.]

Nematospora coryli was isolated from soy-bean seeds of both oil and edible varieties at the Oklahoma Agricultural Experiment Station. The symptoms of infection consist of pale cream-coloured, sunken spots on the seeds, which in severe cases remain small and become shrivelled, and a cheesy or mealy texture of the cotyledonary area involved. Similar lesions were observed on seeds distributed by the United States Department of Agriculture for regional variety tests, and studies are in progress to confirm the identity of the pathogen with *N. coryli*, which if present is evidently widespread throughout the country. The same fungus was also isolated from mung beans (*Phaseolus aureus*), apparently a new host.

Lehman (S. G.). **Occurrence of yeast spot on Soybean in North Carolina.**—*Plant Dis. Reptr*, xxvii, 22, p. 602, 1943. [Mimeographed.]

Nematospora (?)*phaseoli* (*N.* (?)*coryli*) was isolated between August and October, 1943, at the North Carolina Agricultural Experiment Station from a considerable number of soy-bean seeds bearing yellowish to brown areas, involving up to a quarter of one side and in cases of acute infection accompanied by extensive cotyledonary necrosis [see preceding abstract]. Some of the pods containing the diseased seeds showed small discoloured lesions, but others appeared externally sound. Shield-shaped bugs were also present in small numbers and may have introduced the fungal inoculum into the pods in the course of feeding operations. Similar observations were made on a few soy-bean pods in 1928, but the slight degree of parasitism demonstrated by inoculation tests at that time did not seem to justify the publication of a report.

Du Plessis (S. J.). **Swawel vir die bestryding van wingerdsiektes.** [Sulphur for the control of vineyard diseases.]—*Fmg S. Afr.*, xviii, 207, pp. 472–474, 477, 1943.

The results of experiments which have been in progress in South African vineyards since 1933 have fully established the value of sulphur in the control of *Botrytis* [*cinerea*], anthracnose [*Elsinoe ampelina*], powdery mildew (*Oidium*) [*Uncinula necator*], and leaf spot (*Isariopsis* [*fuckelii*: *R.A.M.*, xxi, p. 278]). Directions are given for the treatment of each of these diseases.

Thate (R.). **Ist die Reisigkrankheit der Rebe durch den Boden übertragbar?** [Is the Vine court-noué disease transmissible through the soil?]—*Z. PflKrankh.*, liii, 8–12, pp. 273–283, 1943.

Court-noué, an insidious decline affecting vineyards in the Ahr valley, presents a baffling problem to phytopathologists [*R.A.M.*, xxii, p. 7; cf. also ibid., xxiii, p. 326]. The author's experimental observations on the mode of spread of the disease in two localities in the late winters of 1938–9, 1939–40, and 1940–1 involved the calculation of the theoretical total volume of all new growth (using the truncated cone formula), counts of the number of internodes, double nodes, and shortened joints, the computation of the average length of the first-named, and the determination of dry weight of the wood eliminated in the spring pruning. The results were inconclusive, neither definitely supporting nor altogether contradicting the hypothesis of the movement of court-noué from diseased into healthy stands through the soil.

The outcome of experiments to determine the possible existence of root secretions in the diseased vines, both by P_H measurements of the soil in contiguous and more distant zones, and by the use of the hormone-sensitive *Saccharomyces cerevisiae* as a test organism, was entirely negative.

Anderson (H. W.) & Colby (A. S.). **Dead arm disease of Grape in Illinois.**—*Plant Dis. Reptr*, xxvii, 12–13, pp. 245–246, 1943. [Mimeographed.]

Attention is drawn to an exceptionally severe outbreak of dead arm (*Cryptosporella viticola*) in Illinois vineyards in May, 1943, when the development of the pathogen was promoted by heavy and continuous rains. In the Agricultural Experiment Station vineyard at Urbana almost every vine of the majority of varieties had evidently been infected for at least four or five years, so that ordinary control measures appeared hopeless. The red to purple, elongated lesions of the fungus occurred in profusion on the new growth, and pycnidia were formed abundantly on the two- and three-year-old wood. A table is given showing the reactions to the disease of 56 varieties in 1943, of which the most resistant were

Hartford, Bacchus, Clinton, Norton, Buffalo, Yates, and Westfield; among the next 11 in order of resistance were Carman and Golden Muscat; the 20 with moderate infection included Ontario and Concord; while the susceptible and very susceptible groups comprised, respectively, 13 and 5 varieties.

CONNERS (I. L.) & SAVILE (D. B. O.). **Twenty-third Annual Report of the Canadian Plant Disease Survey, 1943.**—xviii+122 pp., 3 graphs, 1944. [Mimeographed.]

In this report [cf. *R.A.M.*, xxiii, p. 2] it is stated that during 1943, wheat stem rust (*Puccinia graminis*) was of almost no economic importance in the Prairie Provinces of Canada. Infection was rare in Manitoba and Saskatchewan in the former 'rust area', where practically no wheat susceptible to the disease is now grown. In Eastern Canada, however, stem rust appears to have been quite severe in some sections. Stem rust of oats was more prevalent than usual throughout the Prairie Provinces and was moderately abundant in the East. In Manitoba not only were susceptible varieties heavily infected, but heavily rusted spots appeared in fields of resistant varieties. It was shown experimentally that these rusted areas were due to races that hitherto have seldom been present. A heavy aecidial infection of *P. coronata* was noted on *Rhamnus cathartica* in Manitoba, the few bushes of which are situated in towns, mostly remote from oat fields. Common root rot of wheat (*Helminthosporium sativum* and *Fusarium* spp.) was found in all the 114 fields examined in Saskatchewan in 1943. Infection was slight in 17 fields, moderate in 96, and severe in one. Disease ratings were calculated for the individual fields by the examination of upwards of 100 plants from each and the mean rating for the season compared with those for 1941 and 1942. It was evident that the disease was about as prevalent and severe as in 1941, and much more severe in 1943 and 1941 than in 1942.

Browning root rot (*Pythium* spp.) was severe for the first time in many years on wheat in the heavier soils of the Regina plains and of the Rosetown area in Saskatchewan, while a severe outbreak was also recorded in one or two areas in Manitoba.

Barley black smut (*Ustilago nigra*) was again reported from Manitoba, and was found in Quebec for the first time. Nearly 40 per cent. of the samples of barley loose smut obtained from widely separated areas in Quebec proved to be *U. nigra*. This suggests that much of the loose smut in Canada could be controlled by chemical seed treatment. *Selenophoma donacis* var. *stomaticola* and *Septoria nodorum* were reported on barley from Dodsland, Saskatchewan, and Sperling, Manitoba, respectively; both are, apparently, new records for barley in Canada.

A table is given showing the results obtained in a special survey of the diseases present on material from 26 uniform rust nurseries scattered across Canada, containing wheat, oat, and barley varieties.

Seedling blight of flax (*Rhizoctonia* [*Corticium*] *solani*) was more prevalent than usual, causing much thinning of stands in Saskatchewan and Manitoba.

A study of the diseases of certain plants whose cultivation may yet be undertaken on a considerable scale in Canada showed the presence of *Coleosporium delicatulum* on *Euthania* at Ottawa, of *Puccinia hieracii* on kok-saghyz [*Taraxacum kok-saghyz*] across Canada, of [aster] yellows virus (*Callistephus* virus 1) on the same host in the Maritimes, and *Cercospora clavata*, *Uromyces asclepiadis*, and a virus disease tentatively attributed to [aster] yellows virus on milkweed (*Asclepias syriaca*) in Ontario. It was also demonstrated experimentally that *P. carthami* [ibid., xxi, p. 405; xxiii, p. 41], causing safflower rust, is a brachy-form; the presence of pycnidia was confirmed. Evidence was obtained that teleutospores on the seed infect the young crop.

The most important disease of soy-beans in south-western Ontario was blight due to *Fusarium oxysporum* f. *tracheiphilum*, followed by pod and stem blight

(*Diaporthe phaseolorum* var. *sojae*), and downy mildew (*Peronospora manshurica*). Diseases of this crop new to Canada were the leaf spots due to *Phyllosticta sojaecola*, *C. sojina*, and *Septoria glycines*. Blotch (*Helminthosporium turcicum*) of Sudan grass was another new record. Sunflowers at Ottawa showing symptoms of boron deficiency became infected by *Plasmopara halstedii*, which was exceptionally prevalent on this crop.

'Calapproved' bean seed from California gave crops free from bacterial blight (*Xanthomonas phaseoli*) and halo blight (*Pseudomonas medicaginis* var. *phaseolicola*) when the plantings were sufficiently isolated from diseased crops. Carrot bacterial blight (*X. carotae*) is now widespread in Canada, apparently owing to the use of infected seed. Carrot yellows (*Callistephus* virus 1) [aster yellows virus] has now been reported from every province in Canada except Ontario, and will probably soon be reported from there too, as potato purple top was found there for the first time during the past season.

Vegetable diseases recorded as new to Canada included dill [*Peucedanum graveolens*] blight (*Phoma anethi*) [ibid., vii, p. 196] in Ontario, white rust (*Cystopus candidus*) of horse-radish in Quebec, blight (*Heterosporium allii*) of leek in British Columbia, and a spinach leaf spot caused by an undescribed *Cercospora* in Quebec. It is suggested that *Ramularia pastinacae* and *Cercosporella pastinacae* are phases of the same fungus causing leaf spot on parsnip.

Potato bacterial ring rot (*Corynebacterium sepedonicum*) is still prevalent in table stock in several provinces. It was found on more farms than before in southern Alberta, though the average number of diseased plants in the affected fields was smaller; in Manitoba it is an important factor in the poor quality of the potatoes; in Ontario it is not expected to spread further on the principal farms. Leaf roll was very prevalent, this disease being one of the chief difficulties in the production of certified potato seed.

Western 'X' disease of peach [ibid., xxii, p. 421] increased in prevalence in the southern Okanagan Valley, British Columbia, 'X' disease [loc. cit.] increasing slightly in Ontario. What appeared to be *Taphrina pruni* was found in British Columbia; this may prove to be the first authentic material of this fungus in Canada. An authentic record of *Phragmidium rubi-idaei* [ibid., xx, p. 596] on cultivated raspberry was obtained from Ontario. *Pucciniastrum americanum* [ibid., xx, p. 323] was serious on Viking raspberry in New Brunswick, up to 30 per cent. of the fruit being rendered unsaleable in some plantings. *Godronia cassandrae* [ibid., xv, p. 817], previously reported from Quebec, caused serious killing of blueberry bushes [*Vaccinium* sp.] in British Columbia.

Maple leaf spots (*Cylindrosporium pennsylvanicum*, *Phyllosticta minima*, *P. minutissima*, and *Phleospora aceris*) were common in eastern Canada, the last-named being a new record for Canada, while *Phyllosticta minutissima* is new for eastern Canada.

Asters at Ottawa showed heavy infection by *Basidiophora entospora* [ibid., xvi, p. 813]; *Digitalis* spp. at Ottawa were affected by *Phyllosticta digitalis*, a new record; smut (*Entyloma compositarum*) was observed on *Gaillardia* at Ottawa, a new record for eastern Canada; *Pseudomonas gardeniae* was present on *Gardenia* in Ontario, a new record; *Plasmopara viticola* caused heavy infection of *Parthenocissus* (not previously recorded on this host in Canada) and vine [ibid., xiv, p. 324] in Ontario and Quebec; *Cronartium ribicola* was found, for the first time in Manitoba, on *Ribes*, and *Ramularia lactea* occurred on pansy [*Viola tricolor*] in British Columbia, also a new record.

With reference to the earlier report of *Cercospora circumscissa* on *Prunus* spp., including *P. virginiana* and *P. serotina* [ibid., xxiii, p. 4], Dr. Chupp has pointed out (*in litt.*) that the *Cercospora* on *P. serotina* is *C. graphioides*, which is distinct from *C. circumscissa* on the other species of *Prunus*.

Annual Report, Cawthron Institute, Nelson, New Zealand, 1943–4.—35 pp., [1944].

In the sections of this report dealing with research on fruit, tomatoes, and tobacco [cf. *R.A.M.*, xxiii, p. 164] in New Zealand during the period under review (pp. 13–25), it is stated that at Braeburn two applications of 6 lb. ground dolomite or 2 lb. magnesium carbonate applied in 1939–40 and 1940–1 have given almost complete control of magnesium deficiency on Sturmer apples. At Tasman, in an orchard where liberal potassic manuring was formerly practised, results were slower, but almost complete control was also obtained on this variety. Leaf analyses gave the following results in the 1942–3 season: at Braeburn, 0·17 per cent. magnesia on dry matter basis for the Sturmer controls as against 0·34 per cent. for the treated Sturmer trees, the corresponding figures for Jonathan apples being 0·11 and 0·17 per cent.; at Tasman, 0·23 and 0·35 per cent. for the control and treated Sturmer trees, respectively, and 0·22 and 0·28 per cent. for the control and treated Cox's Orange, respectively.

Soil treatments with steam or formalin substantially reduced tomato 'hard core' [loc. cit.]. On steamed and unsteamed soil the percentage of tomato 'cloud' [ibid., xxiii, p. 165] was 11·9 and 8·7 per cent., respectively, while on fertilized and unfertilized soils the figures were 11·8 and 10·1 per cent., respectively. Light and heavy watering reduced and greatly increased cloud, respectively.

Tobacco black root rot [*Thielaviopsis basicola*] was isolated, for the first time, from a commercial field at Dovedale. Angular leaf spot [*Pseudomonas angulata*] was identified in living and cured tobacco leaves. Inoculations of tobacco plants gave positive results with all the strains isolated. A survey of 53 typical fields in the Nelson district showed that angular leaf spot already has a fairly wide distribution in all tobacco-growing localities except the Moutere Valley and Braeburn. One case of *Verticillium* wilt [*V. albo-atrum*] in tobacco was found in Motueka.

Experiments made to ascertain the effect on the final incidence of mosaic in the field of various treatments in tobacco seed-beds confirmed the results of previous years by again indicating that bed-sown plants become less affected than pricked-out seedlings. The results also indicated that fertilizer applications at rates over ½ lb. per sq. yd. are often associated with higher percentages of mosaic when the seedlings are transplanted to the field. The lowest incidence of mosaic was associated with the fertilizer that contained no nitrogen; the highest with mixed fertilizer used at the rate of 1 lb. per sq. yd. In seed-bed tests milk sprays gave significant protection against virus infection through wounds. Both tannin and milk sprays significantly reduced mosaic in tobacco seed-beds where a number of plants had previously been inoculated with the disease. Evidence was obtained showing that the tobacco mosaic virus can persist in infected soil for four months after the incorporation of infected tobacco trash in the soil.

Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, lv, 7, pp. 287–292, 7 figs., 1944.

Leaf mould (*Cladosporium fulvum*) is one of the most serious diseases that growers of glasshouse tomatoes have had to contend with in New South Wales during the past ten years. Recently, it has been prominent in several crops of outdoor tomatoes, and it appears to be increasing in importance locally. Full directions are given for the control of the disease under glasshouse conditions by regulating watering and ventilation, spraying with shirlan AG, and sulphur fumigation [*R.A.M.*, xxiii, p. 166].

Against zinc deficiency of citrus [ibid., xxii, p. 252; xxiii, p. 55] spraying with a mixture of 10 lb. zinc sulphate and 5 lb. hydrated lime per 100 gals. water in early spring once every three to five years is recommended; with deciduous fruits an application of 50 lb. zinc sulphate per 100 gals. water should be given every

year during the dormant period before bud-swell: and vines should be brushed over every year immediately after pruning with a solution of 1 lb. zinc sulphate in 1 gal. water.

Agricultural research.—*Rep. imp. Coun. agric. Res., Delhi, 1942–43*, pp. 1–9, 1943.

On p. 3 of this report [cf. *R.A.M.*, xxii, p. 381] it is stated that the Imperial Council of Agricultural Research, India, has financed a scheme for the suspension of wheat and barley cultivation in the Nilgiri and Palni hills in an attempt to ascertain whether such a step will control wheat rust [*Puccinia graminis*, *P. glumarum*, and *P. triticina*] in the plains of southern India [cf. ibid., xxii, p. 199]. In tests of the reaction of 143 wheats to black stem rust [*P. graminis*] one sample from the Central Provinces was resistant to all six races prevalent in India [ibid., xx, p. 292], and others from Bombay were resistant to five of them.

The Council has also sanctioned (p. 9) a scheme of research on plant virus diseases in the Bombay Province.

Williams (R. O.). **Trinidad and Tobago Administration Report of the Director of Agriculture for the year 1943.**—16 pp., 1944.

The following items occur in this report [cf. *R.A.M.*, xxiii, p. 327], apart from others already noticed from other sources.

On p. 13 C. A. Thorold states that the campaign against cacao witches' broom [*Marasmius perniciosus*: ibid., xxiii, pp. 169, 327] in Tobago has been maintained, the cacao areas being searched and the brooms removed. This disease persists in certain localities, but in other parts little or no infection is present. Apparently, the work being done in Tobago is having some effect on the disease.

A few plots of hill rice in Trinidad were affected by a leaf spot, apparently due to a species of *Piricularia*, probably *P. grisea*, which occurs commonly on crab grass (*Digitaria sanguinalis*). No appreciable reduction in yield occurred. A survey of hill rice plots throughout the Colony revealed no widespread occurrence of this disease, but showed that *Helminthosporium oryzae* [*Ophiobolus miyabeanus*] was prevalent, though not of economic importance.

In co-operation with Dr. E. Phillis attention was given to the recovery and utilization of the 'bottom yeast' from rum distilleries. This can be converted into a useful by-product for feeding to stock. The procedure is to collect the material left at the bottom of the vats after fermentation. It is then washed, dried, and ground to a powder which can be conveniently handled and mixed with stock feeds. This dried material consists of a mixture of yeast and calcium sulphate in about equal amounts; it may contain about 20 per cent. protein.

Report of the Agricultural Department, Dominica, 1943.—9 pp., [? 1944].

On p. 2 of this report [cf. *R.A.M.*, xix, p. 646] it is stated that during 1943 weather conditions in Dominica favoured the development of withertip of limes (*Gloeosporium limetticola*) [ibid., xix, p. 134]. An unidentified disease of vanilla, causing undeveloped flower buds and immature beans to drop, led to severe losses by some growers [cf. ibid., xx, p. 154]. The average monthly incidence of Panama disease (*Fusarium* [*oxysporum* var.] *cubense*) of bananas for all districts was 2·32 per cent. infection as against 1·49 per cent. in 1942. *Cercospora musae* [*Mycosphaerella musicola*] continues to spread [ibid., xix, p. 646].

Report on the Department of Agriculture, St. Lucia, 1943.—16 pp., 1944.

On p. 13 of this report [cf. *R.A.M.*, xviii, p. 717] it is stated that in the second half of 1943 seedling limes of different ages succumbed to the 'red-root' complex [ibid., xxii, p. 355]; only two estates, which are in the northern area, are affected,

but the losses, which have been considerable, are continuing. Sporadic outbreaks of coco-nut bud rot [*Phytophthora palmivora* or bacteria: ibid., ix, p. 90] were promptly dealt with. It was decided to discontinue control work against banana Panama disease [*Fusarium oxysporum* var. *cubense*] as from the beginning of 1944.

Biggs (C. E. G.). **Annual Report, Department of Agriculture, Tanganyika Territory, 1943.**—8 pp., 1944.

On p. 6 of this report it is stated that during 1943 *Hemileia* disease of coffee [*H. vastatrix*: *R.A.M.*, xxi, p. 281] in Tanganyika Territory was only of mild intensity. Wheat yellow rust (*Puccinia glumarum*) was more prevalent than usual, and caused damage in the Northern and Tanga provinces. Potato late blight (*Phytophthora infestans*) [ibid., xxiii, p. 275] spread to the Usambara and Ulaguru mountains and was very destructive in many localities, though the Southern Highlands and Bukoba appear to be unaffected. *Sclerotinia* disease [*S. sclerotiorum*] occurred on various crops and flowering plants. *Ascochyta rabiei*, not before recorded in Tanganyika, caused severe loss in chickpea [*Cicer arietinum*] fields in the Lake Province.

Plant disease surveys in the northeastern United States in 1943.—*Plant Dis. Reptr, Suppl.* 147, pp. 124–229, 1 graph, 1944. [Mimeographed.]

Plant disease surveys in the southeastern United States in 1943.—*Plant Dis. Reptr, Suppl.* 148, pp. 233–302, 2 graphs, 1944.

Plant disease surveys in the western United States in 1943.—*Plant Dis. Reptr, Suppl.* 149, pp. 305–407, 3 maps, 1944. [Mimeographed.]

These supplements give a mass of detailed information concerning the prevalence of plant diseases in the United States in 1943, the data being collected for the individual states by various authors. Special articles in *Suppl.* 148 deal with 'Tobacco diseases in Kentucky' by W. D. Valleau and E. M. Johnson and with 'Diseases of soybeans and peanuts in the Carolinas' by R. E. Atkinson.

McClung (L. S.). **Early American publications relating to bacteriology. I. Text-books, monographs, addresses, etc.**—*Bact. Rev.*, viii, 2, pp. 119–160, 1944.

This partially annotated list of early American publications (1794 to 1915) on bacteriology has been compiled (with the assistance of M. L. Leikind, Library of Congress) in connexion with the project of the Committee on Archives of the Society of American Bacteriologists for the assembly of regional histories of the beginnings of bacteriology in America. It falls into two parts, one arranged alphabetically and the other chronologically.

Spore forming bacteria pathogenic to plants.—*Nature, Lond.*, cliv, 3913, p. 557, 1944.

That some spore-forming bacteria of the *Bacillus subtilis* group can be pathogenic to plants has never been generally accepted by plant pathologists, although P. Brierley [*R.A.M.*, viii, p. 195] showed that a strain of *B. mesentericus* caused rotting of potato tubers, while Madhok demonstrated that rotting of tomato fruits was produced by *B. frutodestruens* [ibid., xxiii, p. 121], a member of the same group; *B. polymyxa* has also been shown to be pathogenic to a number of plants [ibid., xxii, p. 493]. It is known that certain strains of *B. subtilis* secrete pectinases which disintegrate raw potato and are concerned in the separation of flax fibres in retting [ibid., xxiii, p. 186]. It thus appears that some spore-formers of the *B. subtilis* group and *B. polymyxa* possess the necessary enzyme apparatus to attack and destroy the middle lamella of parenchymatous tissues under certain conditions, chief of which is the presence of water.

Gibson (*J. Dairy Res.*, xiii, p. 248, 1944) has shown that this group consists of three main species, each comprising many forms hitherto given distinct specific names. Failure to repeat some of the early work on the disintegration of plant tissues by some of these bacteria may have been due to errors in identification, and the possibility that other spore-formers may possess plant-pathogenic powers requires further investigation in view of the serious losses caused by bacterial rots.

Baker (R. E. D.) & Crowdy (S. H.). **Studies in the witches' broom disease of Cacao caused by Marasmius perniciosus Stahel. Part II. Field studies and control methods.** *Mem. imp. Coll. trop. Agric., Trinidad*, 8, 28 pp., 7 graphs, 1944.

In this further memoir [*R.A.M.*, xxii, p. 242] the authors discuss in detail the results of three years' observations on cacao witches' broom [*Marasmius perniciosus*] made on 76 trees at River Estate, Trinidad. During the course of the work the disease rapidly became worse: under 2,000 fan-brooms were removed in 1939-40, as against 6,000 in 1940-1, and over 10,000 in 1941-2. Some of the information has already been noticed from other sources [ibid., xxiii, p. 94].

The absence of any substantial positive correlation between total leaf flush and total fan-brooms per tree per year was unexpected and suggests that other very important factors besides flush affect variation in numbers of fan-brooms, the most likely being differences in susceptibility to the production of such brooms. The strong positive correlation between the number of flowers produced and the number of cushion-brooms per tree per year suggests that this resistance can hardly be physiological but is probably a form of disease avoidance by the vegetative buds of certain trees. This is supported by the fact that fan-broom and cushion-broom production per tree are not closely correlated. Further, the brooms produced on the supposedly resistant trees are as large as those on the most susceptible trees. It, therefore, does not follow that a tree with resistance to fan-brooms will show comparable resistance to cushion-brooms or pod infection. Conversely, a tree severely attacked by fan-brooms and cushion-brooms might produce pods which by reason of some morphological character might be resistant.

Marked seasonal variation in broom formation was noted, there being a maximum in January or February, and a minimum about June or July, with fluctuating production from August to December or January. Brooms appear with the flushes, which occur five or six times a year, but the total amount of flush in a year has small effect on fan-broom production. Flowering and cushion-broom formation were ascertained to be strongly and positively correlated, an increase in flowering being followed about five weeks later by an increase in cushion-broom formation. In inoculation tests only pods under 6 cm. long could be infected [ibid., xxiii, p. 94].

Shortly before and during the period of maximum broom formation (December and January) the sporophore index is high; similarly, at the end of the dry season, when broom formation is low the sporophore index is also low; while both in 1941 and 1942 the sharp increase in the sporophore index with the first rains was followed some five weeks later by a sharp rise in broom formation. The evidence indicated that the supply of spores is of considerable importance in this disease even in heavily infested areas. Climatic and environmental factors appear to be of major importance in accounting for seasonal fluctuations in broom formation and also for regional differences in disease intensity. A study of such factors is required to complete these investigations.

It has already been shown that dormant buds cannot be infected. For infection to take place young flush must be present and after infection the young flush hardens for a period from three weeks to over three months and the first visible

sign of infection is usually the swollen pulvinus of the subtending leaf. Nothing further happens until the next flush, and if the shoot on which infection has become established misses the flush, it may dry up. True latent infections of the *Colletotrichum gloeosporioides* type do not occur. These facts explain the absence of any high correlation between fan-brooms and current flush figures.

The existence of resistant types in both Trinidad and South America appears to have been proved. For climatic reasons it is likely that in many parts of Trinidad the disease will remain relatively mild; in these areas it will probably be possible to grow high-quality susceptible strains, such as some of the I.C. selections, with success. In localities where infection is severe, all known methods of control are either ineffective or uneconomic, and the only solution is the discovery of a resistant variety.

Baker (R. E. D.) & Dale (W. T.). **Witches' broom disease investigations. VIII. Observations on fan broom formation and loss of pods at River Estate from September 1942 to September 1943. IX. Loss of pods at River Estate. Results to April 1944.**—*Trop. Agriculture, Trin.*, xxi, 9, pp. 170–175, 175–176, 2 graphs, 1944.

In further work on cacao witches' broom [*Marasmius perniciosus*: see preceding abstract] in Trinidad, the removal of fan- and cushion-brooms from the plot of 76 trees was continued for a fourth season. During the period September, 1942, to June, 1943, and not including the early wet-season figures from July to September, no fewer than 18,034 fan-brooms were produced, as against only 10,253 for the whole of the previous season. The correlation that trees which produce many brooms one year do so again the next was once more very strong. By late 1942 and early 1943 the disease reached an intensity at River Estate comparable to that seen in Ecuador, pod infection increasing from 10 to 44 per cent., although much of the crop was set during the dry weather.

Pods have been harvested in this plot for over two years. From October, 1942, to September, 1943, 2,519 pods were removed, of which only 23 per cent. were healthy, and 44 per cent. were destroyed by witches' broom, compared with only 10 per cent. of the harvested pods destroyed by the disease from January to October, 1942.

During 1943 the percentage of diseased pods per tree ranged from 15 to 71 per cent., though the pods on all the trees appeared to be equally susceptible. In the case of fan- and cushion- broom formation, on the other hand, there was statistical evidence for resistance. Other evidence indicated that, so far, the yielding capacity of the trees is unimpaired.

No evidence of resistance to pod attack was forthcoming. Trees which set most of their crop in the dry season largely avoided infection, as pods set between mid-January and the end of April are unlikely to be attacked under the conditions locally prevailing. If a clone could be found that set its main crop at this time of the year, its use might greatly assist in the economic control of the disease, particularly if it was resistant to fan-brooms and was not a free-flowering type which would be severely damaged by cushion-brooms. Though such a clone might be found (and several I.C.S. clones show indications of behaving in this way), it would probably not produce high yields.

In contribution IX it is stated that yield records could not be maintained after April, 1944, owing to the severe trimming to which the trees were subjected in the height of the dry season, but the figures obtained showed that, as in the previous year, diseased pods are at a maximum in January and February; they also suggest that although the 1943–4 season produced a much heavier crop than the previous one, witches' broom was even more severe.

Greenwood (M.) [Ed.]. **Report on the Central Cocoa Research Station, Tafo, 1938–42.**—63 pp., 1 diag., 1943.

In the sections of this report dealing with cacao swollen shoot disease (pp. 44, 51, 56) [*R.A.M.*, xxiii, p. 254] in the Gold Coast it is stated, *inter alia*, that spectrographic analysis of diseased and healthy tissues and of the soils, carried out by Dr. Judd Lewis in England, showed no difference between soils from healthy and affected areas, whilst diseased shoots had a lower ash and a higher silicon content than healthy ones, and diseased chlorotic leaves a higher percentage of manganese and silicon than healthy ones. The increased percentage of these elements is attributed to premature senescence.

In tests of insect transmission by G. S. Cottrell positive results were obtained with cacao psyllid (*Mesohomotoma tessmanni*) nymphs (adults doubtful) in 6 plants out of 6 plants infested, mealy bug (*Pseudococcus* sp.) in 3 out of 3, mealy bug (*Ferrisiana* (*P.*) *virgata*) in 2 out of 5, and cacao aphis (*Toxoptera aurentis*) in 2 out of 6.

Experiments by A. F. Posnette in 1942 demonstrated that the virus passes from scion to stock within 10 days of grafting, that the first symptom is always vein-clearing in young leaves, which generally develops in 10 to 20 (minimum recorded, five) weeks after infection, depending on the incidence of flushing, that neither the number of infecting buds nor their position on the stock has any apparent influence on the time when symptoms first appear or their severity, that ring-barking at least retards the passage of the virus along the branch, and, finally, that the heat inactivation point in budwood is over 45° C. for 30 minutes and 50° for 12 minutes, the lethal points of the budwood itself.

It was established that several strains of the virus [loc. cit.] and probably more than one virus infect cacao. Double inoculations indicated that the Bisa type is a mild strain, capable of conferring some degree of immunity against the prevalent New Juaben strain. The Kpeve type does not induce immunity, and is probably a distinct virus.

Cacao deficiency diseases studied by M. Greenwood included iron chlorosis and sickle leaf mosaic. Typical symptoms of the former appeared where plant ash was incorporated in planting holes and where the lower calcareous horizons of termite mounds were brought to the surface. Spraying with 2 per cent. ferrous sulphate was temporarily effective. 'Sickle leaf mosaic', a characteristic leaf distortion and mottling, has long been associated with the presence of rotting heaps of cacao pods. It is also induced by applications of cacao ash (soluble constituents potassium carbonate and potassium phosphate). The condition was ascertained to be associated with high soil alkalinity and a high soil content of available phosphate.

Johnson (A. G.). Leukel (R. W.), & Haskell (R. J.). **Treat seed grain.**—*Misc. Publ. U.S. Dep. Agric.* 219, 12 pp., 9 figs., 1944.

In this publication (issued 1934, revised 1944, and superseding Miscellaneous Publication 330, Minnesota Seed-Grain Treater, 1938) brief, practical directions are given for the treatment of wheat, oat, barley, flax, maize, and sorghum seed against the principal seed-borne diseases of these crops.

Chester (K. S.). **Low incidence of Wheat leaf rust associated with unfavorable late winter weather and antagonism of Septoria tritici.**—*Plant Dis. Reptr*, xxviii, 8, pp. 280–287, 1944. [Mimeographed.]

Examinations at ten-day intervals from the end of January to 1st April, 1944, each involving 3,000 wheat leaves, revealed no appreciable increase in the incidence of leaf [brown] rust (*Puccinia triticina*) during this critical period [*R.A.M.*, xxiii, p. 433], which in Oklahoma determines the severity of the disease for any given

season. By the latter date, on the average, one leaf in 300 bore a single rust pustule, corresponding to an incidence only $\frac{1}{30,000}$ as high as that recorded on the same date in the epidemic year of 1938. An important factor in the sparse development of the rust was the abnormally cold spell in March (mean temperature in the 28 wheat-growing counties in the western half of the State 45·8° F., compared with a 50-year average of 49°), which checked the reproduction of *P. triticina* and permitted the destruction of the rusted leaves by *Septoria tritici* as fast as new rust infections became established. However, the benefit accruing from the reduction of the rust by *S. tritici* is probably outweighed by the loss of foliage through the attacks of the latter pathogen, resulting as they do in a shortage of winter pasturage and debilitation of the plants on emergence from dormancy.

Johnston (C. O.). **Weather, crop, and cereal disease conditions in Kansas.**—*Plant Dis. Reptr*, xxviii, 19, pp. 622–624, 1944. [Mimeographed.]

The cold late spring is stated to have greatly affected cereal diseases in the western Mississippi Valley in 1944. A survey of three counties east of Manhattan on 10th May revealed no traces of wheat leaf rust (*Puccinia rubigo-vera* var. *tritici*) [*P. triticina*: see preceding abstract]. By 18th May, however, the disease was present in nearly every field in eastern Kansas, extending into Nebraska, and from then on developed fairly rapidly, although, it is believed, not fast enough to cause severe damage, except possibly to late wheat in the western part of Kansas. No wheat stem rust (*P. graminis*) or any rust of oats or barley had developed by that date, but following a change of weather later in the month, both *P. graminis* and *P. coronata* were found as far north as Manhattan. Very conspicuous in the same year were also *Septoria tritici*, *Ustilago tritici*, and an unidentified bacterial leaf spot; traces were found of *Gibberella zeae* and of *Tilletia* spp.

Buchholtz (W. F.). **The Barberry and stem rust.**—*Ext. Leafl. S. Dak. agric. Exp. Sta.* 95, 2 pp., 9 figs., 4 maps, 1944.

This is an excellent popular leaflet on the barberry in relation to cereal stem rust [*Puccinia graminis*] in South Dakota.

Lindfors (T.). **Nya försök med utrotning av Berberis.** [New experiments in *Berberis* eradication.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, viii, 5, pp. 65–69, 1944.

A cheap and effective method of barberry eradication [against wheat rust (*Puccinia graminis*)] consists in strewing dry sodium chlorate (klorex) over the soil beneath the bushes at a dosage of 300 ml. per sq. m.; used at this rate, 240 ml. suffices for a bush with a crown diameter of 1 m. In recent tests in different parts of Sweden [*R.A.M.*, xxiii, p. 171], early summer (14th June) treatments gave rather better and more rapid results than those applied in the autumn (28th October).

Glasscock (H. H.) & Ware (W. M.). **Frost injury to the straw of Wheat.**—*J. Minist. Agric.*, li, 8, pp. 340–341, 1 fig. (facing p. 361), 1944.

Following severe frost in May, 1944, Vilmorin wheat growing near Wye, Kent, developed die-back of the leaves from the tip. The lowest internode or the one next to it was water-soaked and sometimes showed a brown discoloration of the tissue, while one or both of the two lowest nodes were brown. Wheat of Squarehead's Master variety also showed browning of the tips of the leaf blades, but to a less conspicuous degree; the tissue of one or both of the two lowest internodes was partially collapsed, and was white or silvery, but there was no node

discoloration. This variety had lodged in patches. Other wheat crops in the same locality showed similar stem symptoms, but the dying-back of the leaf tips was less marked.

In July wheat in Kent and Sussex showed poorly filled ears and a large proportion of shrivelled grain, blackening of the ears being associated with the condition; in nearly every case, frost damage was apparent on the stem. In the authors' opinion injury by frost to the cortical tissue to such an extent as to girdle the stem, particularly in association with the drought conditions that prevailed in 1944, accounts for much of the loss of yield in wheat in south-eastern England in that year. Holdfast wheat appeared to show resistance to frost injury.

Tervet (I. W.). **Survey of the microflora of Barley seed from Minnesota, North Dakota, and South Dakota.**—*Plant Dis. Reptr.* xxviii, 14, pp. 468–476, 3 maps, 1944. [Mimeographed.]

Helminthosporium spp. predominated among the microflora of 68 lots of barley seed-grain from the 1943 harvests in Minnesota and North and South Dakota, *H. sativum* being the most prevalent, while *H. teres* was present to the extent of 17 per cent. in one lot from Renville County, North Dakota, and was not uncommon elsewhere in the northern sections of the same State and Minnesota. Other contaminants included *Fusarium*, *Alternaria*, *Aspergillus*, *Penicillium*, and *Mucor* spp., *Brachysporium* sp., and *Gibberella saubinetii* [*G. zeae*], the last-named occurring principally in the Minnesota Valley region of Minnesota and in eastern South Dakota. In isolating the fungi present the seed grain was disinfected by two minutes' immersion in 0·1 per cent. mercuric chloride and 0·3 per cent. vatsol followed by five minutes in 0·35 per cent. sodium hypochlorite and 0·3 per cent. vatsol, in order to prevent the over-running of the acid potato dextrose agar cultures by *Rhizopus nigricans* [*R. stolonifer*], which developed from many of the seeds.

Soukhov (K. S.). Доказательство инфекционности очищенного белкового препарата вируса мозаики Овса (закуклivания Овса). [Proof of the infectivity of the purified protein preparation of the virus of Oats mosaic (zakuklivanie of Oats).]—*C. R. Acad. Sci. U.R.S.S.*, N.S., xl, 4, pp. 190–192, 1943.

The author demonstrated, at the Ufa Field Experiment Station, the infectivity of the purified protein preparation of the virus of oats mosaic [pseudo-rosette: *R.A.M.*, xxiii, p. 213] by feeding sterile larvae of the third generation of the vector, *Delphax* [*Delphacodes*] *striatella*, on a suspension of the crystalline preparation and later placing the larvae on isolated healthy oats seedlings. The 60 larvae thus treated caused infection in 18 per cent. of the plants after about one month (or 21 per cent. at the end of the experiment, a week later), while there was no infection in the control isolator containing 400 sterile larvae, and 1 per cent. in the adjacent field. An examination of a number of larvae after feeding revealed, in 7 out of 10, the presence of numerous crystals of the virus in the intestines. In the course of the experiments it was further found that the virus passes through the Seitz filter; that it remains viable after half-an-hour in a freshwater suspension of mosaic-diseased leaves; that the purified preparation remains active after seven months' storage; and that no infection results from feeding the vector on a water extract from dry mosaic-diseased leaves.

Soukhov (K. S.), Vovk (A. M.), & Alexeeva (Mme T. S.). **Purified protein preparation from the virus of Oat mosaic (zakuklivanie).**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xli, 8, pp. 344–346, 1 fig., 1943.

The extraction of the oat mosaic ('zakuklivanie') [pseudo-rosette] virus [see preceding abstract] and its precipitation with hydrochloric acid, using a method

devised by the first-named author for the purification of winter wheat mosaic [*R.A.M.*, xxii, p. 59] (*Microbiology*, Moscow, ix, 2, 1940), produced a milky-white substance composed exclusively of birefringent needle-like crystals. A suspension of the preparation was submitted to the biuretic test for protein with positive results in the shape of a clear violet ring in the test tube. The crystals can be obtained either from fresh or dry mosaic leaves. Irreversible coagulation of the protein took place in leaf fragments exposed to a temperature of 50° C. for 20 minutes or to 60° for ten.

Stanton (T. R.) & Down (E. E.). **Downy mildew of Oats in Michigan.**—*Plant Dis. Reptr*, xxvii, 18, p. 434, 1943. [Mimeographed.]

On 27th July, 1943, *Sclerospora macrospora* was collected on two oat selections (C.I. Nos. 3664 and 3909) from a D69 × Bond cross being grown at East Lansing, Michigan. The infected plants were 2 to 3 in. taller than healthy ones, and had contorted panicles. Oospores were abundantly present, particularly in the leaf tissues. The disease has been reported only once before in the United States [*R.A.M.*, xxi, p. 8].

Hyre (R. A.). **Cercospora zeae-maydis on Corn in eastern Tennessee and Kentucky.**—*Plant Dis. Reptr*, xxvii, 20, pp. 553–554, 1943. [Mimeographed.]

Field observations in eastern Tennessee and Kentucky from 8th to 11th September, 1943, revealed a considerable amount of leaf-spotting due to a *Cercospora*, identified by Dr. C. Chupp as *C. zeae-maydis*, a common species in South America [*R.A.M.*, xv, p. 633], but definitely recorded within the U.S.A. only from Illinois. *C. sorghi*, widespread in all the southern States, was also present to a slight extent. In Tennessee the maximum incidence of leaf spot due to *C. zeae-maydis* was 94 and in Kentucky 45 per cent., the corresponding figures for bacterial leaf blight [*Xanthomonas stewarti*] being 16 and 82 per cent., respectively.

Vaheeduddin (S.). **The pathogenicity and genetics of some Sorghum smuts.**—*Tech. Bull. Minn. agric. Exp. Sta.* 154, 46 pp., 6 pl., 4 figs., 1942. [Received October, 1944.]

In this account of the author's comprehensive study of the nature and origin of the physiologic races of *Sphacelotheca sorghi* [*R.A.M.*, xviii, p. 18] it is stated that three chlamydospores were germinated from a single sorus of a Texas collection of the fungus, single sporidia isolated, and the resulting haploids crossed. One cross gave brown and the other grey heads in inoculated sorghum plants. Four crosses were made between F_1 lines, two within the brown type, and two between brown and grey. From the intrabrown and brown × grey crosses 28 chlamydospores were germinated, and segregation of factors for cultural characters and sex appeared to be independent. The Bauch test [ibid., xii, p. 88] was found to be a reliable method for determining sex in *S. sorghi*. The evidence obtained indicated the presence of multiple factors for sex and also showed that different dicaryophytes differ in pathogenicity, while multiple factors may be present for the inheritance of grey colour.

The percentage infection of sorghum with *S. sorghi* was moderately high when the seed germinated at an average soil temperature between 50° and 70° F., whereas at a lower temperature infection markedly decreased. One collection of the smut, now designated race 6, differed in pathogenicity from the five races hitherto described. A new key for the identification of all six physiologic races is provided.

Of the seed disinfectants tested new improved ceresan prevented infection entirely, while ceresan, Kopper's flotation sulphur, wettable sulphur, powdered flowers of sulphur, gas sulphur, and kolodust also gave effective control.

The Bauch test showed no reaction when haploid lines from *S. sorghi* or *S. cruenta* were mixed with haploid lines of *Sorosporium reilianum*. No sporidial fusions were noted when monosporidial lines from *Sphacelotheca sorghi* or *S. cruenta* were mixed with monosporidial lines of *Sorosporium reilianum*. There was evidence that sexual compatibility of monosporidial lines from *Sphacelotheca cruenta* and *Sorosporium reilianum* can be detected by inoculating sorghum with them. Sexually compatible lines produce chlorosis 8 to 12 days after inoculation, and chlorotic plants later develop sori containing chlamydospores. *Sphacelotheca cruenta* and *Sorosporium reilianum* are interfertile; sexually compatible monosporidial lines of these two genera, when paired, can cause infection. Different monosporidial combinations of the two genera produced sori which resembled those of *Sphacelotheca cruenta*, *Sorosporium reilianum*, *Tolyposporium filiferum*, or were very narrow and up to 7 cm. long.

The F_1 chlamydospores of the hybrid *Sphacelotheca cruenta* × *Sorosporium reilianum* are echinulate and of intermediate size, the promycelia and sporidia being significantly larger than those of the parents. The hybrid chlamydospores have a higher optimum germination temperature (30° C.) than the parents (25° and about 27°, respectively). The ratios of segregation of factors for cultural characters in the F_1 lines of the hybrid were 4 : 0, 3 : 1, 2 : 2, 1 : 2 : 1, and 1 : 1 : 1 : 1, while those for segregation of factors for sex were 2 : 2, 1 : 2 : 1, and 1 : 1 : 1 : 1. Monosporidial lines from two promycelia fell into seven sex groups when paired in all possible combinations. Variants appeared in monosporidial cultures of the hybrid which were culturally distinct from the parent colonies. Other evidence demonstrated that the hybrid is heterothallic and causes normal infection, and indicated that different combinations of sporidial lines have different degrees of pathogenicity, whereas monosporidial lines alone caused no infection.

Some of the F_2 sori produced from different combinations of F_1 lines resembled the grandparental types, while others were like *T. filiferum* or like some of the F_1 types, with very narrow, long sori. The F_2 chlamydospores are echinulate and germinate by long promycelia. Some F_2 lines on potato dextrose agar resembled haploid lines of *Sphacelotheca cruenta* and *Sorosporium reilianum*, while others resembled colonies of F_1 lines. Heterosis was evident.

Cytological studies of nuclei in the promycelia of *Sphacelotheca cruenta*, *Sorosporium reilianum*, and the hybrid gave evidence that there are four chromosomes in diploid, and two in haploid, nuclei.

Mundkur (B. B.). **Studies in Indian cereal smuts. VI. The smuts on Sawan (Echinochloa frumentacea).** –*Indian J. agric. Sci.*, xiii, 6, pp. 631–633, 1943.

Echinochloa frumentacea, known locally as 'sawan', 'sama', 'banti', 'sawank', or 'kuthiraivalli', is cultivated on a small scale in several parts of India, where it is eaten by the poorer classes. It also yields a valuable forage, and was exploited some years ago in the United States as a 'billion-dollar grass'.

The crop is free from important diseases except for two smuts, *Ustilago panici-frumentacei* and *U. paradoxa*, while it is also attacked by a third. According to Brefeld (1895) in ears attacked by the first-named smut not all the grains are infected. The diseased grains are twice the normal size and filled with a pulverulent mass of spherical, brownish spores 7 to 9 μ in diameter. The second smut mentioned is also ovariicolous. It, too, attacks only a few grains in an ear, but its spores are larger and perfectly smooth. Whereas the spores of *U. panici-frumentacei* germinate by the formation of a septate promycelium and lateral and terminal sporidia, those of *U. paradoxa* give out a long, branched, septate hypha without promycelium or sporidia. This fungus has been reported from Pusa, Sind, and the Bombay Province.

The third smut causes much host deformity, turning it into a twisted mass of

shoots with aborted ears. Sori occur in the inflorescence, on the nodes and young shoots, and at the axils of the older leaves. The spherical spores show thick, blunt echinulations. Butler referred this fungus to *U. panici-frumentacei*, but a comparison with the type did not bear out this identification, the spherical to slightly ellipsoidal 'Mikado brown' spores, 8·9 to 11·9 μ in diameter and with a thick epispore covered with blunt, dense echinulations or warts leaving little doubt that the fungus is actually *U. crus-galli* Tracy & Earle. The paper concludes with revised descriptions of the three organisms.

Gomez Clemente (F.). **La 'psoriasis' o 'corteza escamosa' del Naranjo.** ['Psoriasis' or 'squamous cortex' of the Orange.]—*Bol. Pat. veg. Ent. agríc., Madr.*, xi, pp. 97–112, 11 figs., 1942. [Received August, 1944.]

Psorosis (for which the writer prefers the designation 'psoriasis') was first observed in Spain (in the valley of Cárcer) in 1933: during the years of the civil war the disease extended its range and assumed a more severe form. At the time of writing, reports of its occurrence, mostly on Washington Navels on 'blood' orange stocks, had been received from a number of localities in Valencia, Castellón, Alicante, and Murcia. Grafting appears to be the principal means of transmission of the virus responsible for the trouble, the prophylaxis of which should therefore be based on the use of scions from healthy trees at least 15 years old, since infection may be harboured in a latent form by younger ones. Once the disease has gained ingress into a grove the only curative treatment consists in scarification of the squamous bark and the application to the exposed surface of a fungicidal paste, e.g., 2 kg. copper sulphate and 4 kg. lime in 20 l. water, 9 kg. each of sulphur and powdered lime in 16 l., or 8 l. lime-sulphur and 6 kg. lime in 14 l.

Summerville (W. A. T.) & Blackford (F. W.). **Deficiency diseases of Citrus.**—*Qd agric. J.*, lviii, 6, pp. 362–366, 2 figs., 1944.

The only citrus deficiency diseases so far associated with serious losses in Queensland are those due to lack of zinc (mottle leaf), copper (exanthema), nitrogen, and iron.

Mottle leaf can be controlled by spraying the foliage with a mixture consisting of 4 lb. zinc sulphate and 2 lb. hydrated lime in 40 gals. water [cf. *R.A.M.*, xvii, p. 170]; on slightly affected trees a half-strength mixture may be used. Application is usually made at the flush of young growth in spring in combination with a routine application of cuprous oxide. In localities where fumigation is resorted to against insects, a zinc sulphate spray in which caustic soda is used instead of hydrated lime at the rate of 4½ oz. to each lb. of zinc sulphate is recommended for combination with the copper mixture.

Under Queensland conditions exanthema seems generally to be associated with inability of the tree to absorb copper, even when an ample supply is present; faulty drainage and a hard pan near the soil surface are commonly found where this disease is present. To obtain permanent control the physical condition of the soil must first be corrected, if necessary. After this, fertilizer applications should be made, care being taken not to apply too much nitrogen, which should be supplied in light dressings at long intervals. The bunched twigs should be thinned out and the dead wood removed. Spraying with a cuprous oxide mixture (3 gals. stock solution to 40 gals. water) [ibid., xx, p. 59] effects a rapid cure. The routine sprays are sufficient for the purpose, or, if these are not applied, an application should be made in spring when the fruit has been set, and repeated later if necessary. A somewhat less satisfactory method is to sprinkle fine copper sulphate crystals on the ground under the tree at the rate of 1 to 4 lb. per tree and then chipping them in.

Against nitrogen deficiency [ibid., xx, p. 461; xxiii, p. 106] a general remedial

measure is the application of a liberal ration of nitrogenous fertilizer, but it is essential also to ensure that the soil conditions are otherwise suitable for citrus growing.

Under Queensland conditions, iron deficiency [ibid., xx, p. 461] can generally be remedied by applying up to 4 lb. sulphate of iron to the soil under each tree.

Neal (D. C.). **Rhizoctonia leaf spot of Cotton.**—*Plant Dis. Reptr*, xxvii, 18, p. 435, 1943. [Mimeographed.]

In July, 1943, a leaf spot of mature cotton plants due to a fungus, the vegetative stages of which agreed closely with Duggar's description of *Rhizoctonia* [*Corticium*] *solani*, was found at Baton Rouge, Louisiana, this being, apparently, the first record of this fungus on the leaves of mature cotton. The symptoms appeared as light brown, irregularly shaped, interveinal spots with a dark purplish ring; as the fungus advanced, the tissues round the spots became chlorotic and the necrotic area of the old spots cracked or fell out.

Paillot (A.). **Sur une nouvelle mycose des chenilles de Pieris brassicae L.** [On a new mycosis of the larvae of *Pieris brassicae* L.]—*C.R. Acad. Sci., Paris*, ccxvii, 16, pp. 383–384, 1 fig., 1943.

In a planting of Saint Genis-Laval cabbages the author observed *Pieris brassicae* larvae presenting a completely abnormal aspect, the characteristic yellow and black bands having entirely disappeared except for one narrow dorso-median line, and the body being of a uniformly purplish-brown colour. The blood of the diseased insects contained large numbers of fusiform, binucleate hyphae, usually furnished with a transverse median septum and measuring 12 to 14 by 3 μ; they are reminiscent of those described by Speare in connexion with *Sorosporella uvella* (Krass.) Giard, parasitic on Noctuid larvae (*J. agric. Res.*, xviii, pp. 399–439, 1920), while some analogies with *Massospora* are also apparent. The inoculation of normal larvae with a drop of blood from an infected specimen resulted in active mycelial development and the formation of multiseptate hyphae up to 140 μ long.

The cultural characters of the fungus on various nutrient media are briefly described. A peculiar feature of the growth on oatmeal agar consists in the formation of rounded, greyish strands composed of long hyphal agglomerations; two years after plating out ten such structures were present on the surface of the medium, some of them up to 4 or 5 cm. long and much branched. Arthrospores of irregular shape were the sole form of fructification observed; they gave rise to a mycelium of a much more slender type than that occurring in the host.

Cheo (C. C.). **A study of Collybia albuminosa (Berk.) Petch, the termite-growing fungus, in its connection with Aegerita duthiei Berk. (Termitosphaeria duthiei (Berk.) Ciferri).**—*Sci. Rec.*, Chungking, 1, 1–2, pp. 243–248, 14 figs., 1942. [Received July, 1944.]

The conidia of *Collybia albuminosa*, which is widely distributed in Yunnan, China, do not germinate readily. Pure cultures may, however, be obtained from the internal tissues of the gills or stipes. At room temperature the best growth is made on 0·2 per cent. malt extract, 2 per cent. potato dextrose, and oatmeal agar, a diameter of 2 cm. being attained in two months. On potato dextrose and oatmeal agar, white, spherical, sessile bodies, 0·5 to 1 mm. in diameter, are produced either singly or, more commonly, in dense masses on the stromata. The interior of the spherical structure is composed of interlacing hyphae, swollen into chains of oblong, cylindrical, or oval cells, occasionally dichotomously branched, which on maceration break up into conidia. Similar white bodies are produced by *Aegerita duthiei* (renamed by Ciferri *Termitosphaeria duthiei* [*R.A.M.*, xv, p. 500]) in termite combs, and on transference to agar slants they develop in the

same way as the tissue cultures of *C. albuminosa*: the observed facts appear to point to a genetic connexion between *A. duthiei* and *C. albuminosa*.

It is the habit of the worker termites to transfer the spheres from one part of the comb to another, utilizing them similarly to soil particles for repair purposes; on examination the translocated globules were shown to contain dissociated conidia and mycelia.

Sproston (Nora G.). **Ichthyosporidium hoferi (Plehn & Mulsow, 1911), an internal fungoid parasite of the Mackerel.**—*J. mar. biol. Ass., U.K.*, xxvi, 1, pp. 72–98, 44 figs., 1944.

This is a comprehensive study of a virulent disease of mackerel in British waters, which has been causing up to 100 per cent. infection since 1940, associated with the presence in the viscera, especially the kidneys and spleen, of *Ichthyosporidium hoferi* (Plehn & Mulsow) Pettit (Entomophthoraceae) [*R.A.M.*, xiii, p. 700]. The fungus developing in the necrotic tissues may show (*a*) bunches of large, elongated chlamydospores with a very hard exospore and a thick, gelatinous endospore; (*b*) single dome-shaped conidia; (*c*) hyphal bodies of various shapes, some becoming circular and encysted and subdividing irregularly, each spherule with a separate cyst; (*d*) branched conidiophores with rounded tips containing endoconidia, liberated as minute amoeboid bodies into the blood-vessels; (*e*) simple, clavate sporangia from the ends of unbranched hyphae, also containing endoconidia; (*f*) hyphal fusions of many types immediately proceeding to further outgrowths of similar hyphae; and (*g*) fusion of two hyphae, followed by the participation of neighbouring hyphae, which also contribute to the formation of the outer resistant, rugose wall.

Brierley (P.) & Smith (F. F.). **Studies on Lily virus diseases: the necrotic-fleck complex in Lilium longiflorum.**—*Phytopathology*, xxxiv, 6, pp. 529–555, 11 figs., 1944.

Two subtypes of the necrotic fleck disease of Easter lilies (*Lilium longiflorum*) [*R.A.M.*, xix, p. 411] in the Louisiana Delta are differentiated as 'sparse fleck' and 'very sparse fleck'. The former is comparable to Ogilvie and Guterman's mosaic type B [ibid., viii, p. 578], while the latter, consisting merely of very sparsely distributed necrotic flecks, would in all probability be overlooked in the field, though perceptible in certain commercial varieties under glass; it does not detract from the saleability of the plants.

The necrotic fleck disease, a complex of the cucumber mosaic virus and a hitherto unreported virus herein designated 'lily-symptomless virus' or *Adelonosus lilii* n.g., n.sp., is mechanically transmissible to *L. longiflorum* seedlings only with difficulty (3·6 per cent. positive results), but is readily conveyed to commercial Easter lilies, e.g., Creole, Croft, and Giganteum (87 per cent. successful). The cucumber mosaic virus induces necrotic fleck symptoms in commercial Easter lilies, but not in previously virus-free *L. longiflorum* seedlings, which also responded negatively to inoculation with a mixture of the cucumber mosaic and lily mottle viruses. The latter, a common concomitant of necrotic fleck in Easter lilies, was found to be absent from plants in which the disease was experimentally induced, and cannot, therefore, in contradistinction to the lily-symptomless virus, be regarded as an essential component of the complex.

Necrotic fleck was transmitted to previously virus-free Easter lily seedlings only by *Aphis gossypii*, though positive results were also obtained with *Macrosiphum solanifolii* and *Myzus persicae* in experiments with the cucumber mosaic and lily mottle viruses. *A. gossypii* further transmitted the cucumber mosaic virus from necrotic-flecked *L. longiflorum* to *Calochortus* sp., *Colchicum autumnale*, *Gloriosa*

rothschildiana, and *Fritillaria pudica*, not hitherto recorded as susceptible to the disease.

Lily-symptomless virus is only definitely known to occur in Easter lily, though there is some doubt as to the susceptibility of the Clara Butt tulip, *C. autumnale*, and *G. rothschildiana*. It is harboured by the Norwood strain of Creole Easter lily in combination with the lily-mottle virus. Sap transfers from the host in question do not result in necrotic-fleck development in Easter lily seedlings previously infected by cucumber mosaic, but *A. gossypii* acts as a vector of the former virus to seedlings already harbouring the latter, while either sap or aphid transfers of cucumber mosaic to Norwood Creole readily synthesize necrotic fleck.

The latent period of four to six days spent by the lily-symptomless virus in *A. gossypii* serves to differentiate it from lily mottle, a fact of interest to growers who have decided on practical grounds to eradicate necrotic fleck-diseased plants while ignoring mottle. The absolutely virus-free cultivation of Easter lilies on a commercial scale is agreed to be impracticable.

Thirumalachar (M. J.). **Wilting of shoots in scented Geranium (Pelargonium odoratissimum).**—*Nature, Lond.*, cliv, 3912, pp. 515–516, 2 figs., 1944.

Large numbers of *Pelargonium odoratissimum* plants in Bangalore became affected by a shoot wilt due to infection by a species of *Sphaeropsis*. When the collar region became involved the plants succumbed. The pathogenicity of the fungus was established experimentally. The intercellular mycelium was purplish-black and the glassy, hyaline, ovate to cylindrical spores measured 18 to 24 by 11 to 14 μ. In moist weather, they emerged from the long, narrow ostiole and they became brown after extrusion from the pycnidium. Later they became *Diplodia*-like, the exospore being traversed by longitudinal, hyaline streaks. The identity of the *Sphaeropsis* could not be established, but attention is drawn to *S. pelargonii* recently described on *P. zonata* in Portugal [*R.A.M.*, xvi, p. 563].

Schander (H.). **Gedanken über Unterschiede und Übereinstimmungen der Chloroseerscheinungen von Lupinen und Holzgewächsen.** [Considerations on the differences and correlations in the manifestations of chlorosis in Lupins and woody plants.]—*Gartenbauwiss.*, xvii, pp. 304–309, 1943. [Abs. in *Chem. Zbl.*, cxiv (ii), 18, p. 1642, 1943.]

From his studies at the Kaiser Wilhelm Institute for Plant Breeding and the Erwin Baur Institute at Müncheberg, Mark Brandenburg, the writer concludes that juvenile chlorosis of lupins [*R.A.M.*, xv, p. 373; xvi, p. 42] is attributable to a stoppage in the transport of reserve iron from the cotyledonary leaves, which occurs when the hydrogen-ion concentration of the sap stream exceeds P_H 4·8 to 5. The P_H value is determined by (1) the acidity or alkalinity of the soil in the immediate vicinity of the roots, and (2) the capacity of the plant to regulate the hydrogen-ion concentration of its juices, the latter declining with an increase in the volume of fluid through enhanced transpiration. Typical chlorotic symptoms are absent in older plants at the optimum P_H value of 6·75. The more rapidly this point is attained, the more effectively is the critical situation in respect of chlorosis surmounted. Hence the development of the trouble is promoted by long, cold, rainy periods which retard growth. Hypothetically, similar interrelationships between soil and plant P_H values should be operative in the case of woody plants, but here experimental confirmation presents difficulties.

Weimer (J. L.). **Some root rots and a foot rot of Lupines in the southeastern part of the United States.**—*J. agric. Res.*, lxviii, 12, pp. 441–457, 8 figs., 1944.

Investigations carried out over a period of four years have shown that root rots of lupins (*Lupinus angustifolius*, *L. luteus*, and *L. albus*) in the United States

are caused by several fungi, of which *Fusarium* spp. [*R.A.M.*, xxiii, p. 231] are considered to be the most destructive. The most frequently isolated species, responsible for most of the root rot of lupins in the south-eastern States, was a new form of *F. oxysporum*, for which the name *radicis-lupini* [with a short description] is proposed, distinct from the form *lupini*, responsible for a vascular wilt in Europe [ibid., xxii, p. 161]. The fungus was found to vary considerably in its pathogenicity, producing 44·3 per cent. infection in *L. albus*, 60 per cent. in *L. luteus*, and 65·8 per cent. in *L. angustifolius*; it appeared very sensitive to environmental conditions, causing in some years and localities great destruction while in others the disease was of little economic importance. The symptoms produced and the rate of spread through the plant tissues varied greatly in both naturally and artificially infected plants. In the field, infected plants may be killed in the seedling stage or later in the season, but some may mature seed and appear entirely normal until the plants are pulled and the decaying roots exposed. Wilting and dwarfing do not usually become conspicuous until the hypocotyl or root system is badly decayed. The colouring of the decaying tissue also varies greatly from light to darkest shades of red or brown. *F. moniliforme* [*Gibberella fujikuroi*] was isolated repeatedly and proved pathogenic to all three host species, producing cankers on the hypocotyls, but it is not considered responsible for any large proportion of root-rotting of lupins in the field. It might, however, under conditions favourable for rapid development cause considerable damage. The lesions produced by this species under experimental conditions were straw-coloured and not very deep, but otherwise similar to those caused by other *F.* spp. *F. solani* f. *lupini* n.f. [with a short description], isolated from a single plant of *L. angustifolius*, proved to be pathogenic to all three host species, spreading more rapidly and producing darker lesions than *F. oxysporum* f. *radicis-lupini*. *F. solani* f. *pisi*, isolated from a pea plant, proved pathogenic to *L. luteus* and *L. angustifolius*.

Rhizoctonia [*Corticium*] *solani* [loc. cit.] was found occasionally in association with *Fusarium* root rot in the field. Inoculation experiments showed that this fungus is capable of causing considerable damage to young lupin plants, but not to old ones, except, possibly, under extremely favourable conditions. No species of *Pythium* [loc. cit.] was isolated from naturally infected lupin roots, but *P. graminicola* was proved experimentally to be pathogenic to *L. albus* and, to a very slight degree, to *L. luteus*.

A foot rot due to *Sclerotium rolfsii* is stated to be, next to the root rots, the most common and destructive disease of lupins studied. The plants are attacked near the surface of the soil, the developing lesion gradually girdling the stem, with subsequent stunting and later wilting and death of the plant. Young seedlings may be killed within a few days, but older plants succumb more slowly. Usually only isolated or small patches were observed to be affected in the field, but the total percentage of plants lost in a small patch at times may be high.

Louw (A. J.). **The control of fungus diseases in the orchard.**—*Fmg S. Afr.*, xviii, 207, pp. 450–454, 2 figs., 1943.

Directions are given for the control of apple, pear, and stone fruit diseases in the winter rainfall area of South Africa, with special reference to the adaptation of the spraying programme to prevailing climatic and soil conditions.

Lindner (R. C.) & Harley (C. P.). **Nutrient interrelations in lime-induced chlorosis.**—*Plant Physiol.*, xix, 3, pp. 420–439, 1944.

This tabulated account of the writers' exploratory studies at Wenatchee, Washington, on lime-induced chlorosis, mostly in fruit trees, is supplemented by a discussion of the problem in the light of contemporary researches, many of which have been noticed from time to time in this *Review*.

The foliage of trees affected by the disorder tends to be high in potassium, but rather low in calcium and magnesium. Data are presented on the distribution of calcium, potassium, magnesium, phosphorus, iron, and manganese in various fractions of green and chlorotic leaves of Delicious apple and Bartlett pear, and of green and genetically variegated *Spiraea* sp. Potassium was found to be mostly water-soluble, magnesium and manganese either water-soluble or readily dissociated by 0·1 N hydrochloric acid, while calcium, phosphorus, and iron were more uniformly distributed in all the fractions. More than half the last-named mineral was present in a form insoluble in 1 N hydrochloric acid, presumably as complex organic compounds, such as iron haematin or iron-nucleoprotein. No correlation could be established between the total iron, electro-dialysable iron, insoluble iron or iron soluble in water, ether, alcohol, 1 N acetic acid, 1 N ammonium hydroxide, or 0·1 or 1 N hydrochloric acid and the development of lime-induced chlorosis, which is probably brought about by a complex of interrelated factors, not as yet fully understood. The data at hand suggest that a relatively high potassium level induces chlorosis by replacing the iron in the enzyme responsible for chlorophyll formation, thereby inactivating the latter.

Tyler (L. J.). **Apple storage diseases in New York.**—*Plant Dis. Reptr*, xxviii, 8, pp. 298–311, 1944. [Mimeographed.]

From this tabulated survey of observations made between 7th February and 25th March, 1944, in 40 cold-storage warehouses distributed over the three main apple-growing areas of New York State, it appears that surface moulds (mostly *Penicillium* spp.) were generally more troublesome in overhead-coil than in blower-type plants. Ozonization [*R.A.M.*, xxi, p. 209] eliminated moulds of this type almost completely, while formaldehyde and lime-sulphur were also effective in their suppression. On the whole, however, strict sanitation was not widely practised, excessive humidity, for instance, being prevalent in overhead-coil storages. Only 3 per cent. of the 300 apple lots examined were enveloped in oiled wrappers or shredded oiled paper as a precaution against scald [ibid., xxi, p. 457; xxii, p. 212]. Besides this and other physiological disorders, sixteen fungal pathogens were noted in the various lots, and the incidence of these diseases in cold stores with overhead coils and blowers tabulated.

A disease of the Northern spy variety, herein termed Spy spot, was found in all parts of New York State, where it has been present for several years, and was also noted on fruit from Pennsylvania, Vermont, and Massachusetts. The disease is characterized by circular to ovate, brown, sharply sunken lesions from a pencil-point dot to more than $\frac{1}{8}$ in. in diameter, usually found on the stem end and sides of the fruit in numbers up to 100 or more lesions per fruit. Of the different lots of Spys examined, 65 per cent. manifested the disease.

English (H.). **Notes on Apple rots in Washington.** *Plant Dis. Reptr*, xxviii, 19, pp. 610–622, 2 diags., 1944. [Mimeographed.]

From tabulated data collected between 1939 and 1943 from inspection certificates on the incidence of decay in Delicious and Winesap apples held in cold storage in Wenatchee and Leavenworth, Washington, and from precipitation records, the author concludes that the critical precipitation from the standpoint of fungous decay is principally that which occurs during the actual harvest period. Rain and water from melting snow may favour fruit infection by (1) carrying conidia of the bull's-eye rot fungus (*Neofabraea perennans*) [*R.A.M.*, xxii, p. 29] and possibly others from the branches to unpicked fruits or apples stacked beneath the trees; (2) promoting sporulation and germination of the fruit-rotting fungi; (3) favouring arsenic injury; (4) retarding the healing of wounds and the closing

of lenticels; and (5) delaying picking beyond the optimum date. Winesap apples from the Leavenworth district late in the storage season showed twice as much decay as the same variety from Wenatchee. Blue mould rot (mostly *Penicillium expansum*) [ibid., xxii, p. 100] again predominated in both districts and *N. perennans* was also important.

Experimental apples harvested under favourable conditions and promptly cooled to 31° to 32° F. developed very little decay even when stored until May. The chief points of infection with blue mould were punctures, lenticels, and the calyx basin; and with bull's-eye rot lenticels, followed in decreasing order by calyces, punctures, worm injuries, and cracks adjacent to the stem. The latter disease rarely occurs in cold storage prior to January, but once it has appeared it acts rapidly and disastrously. Other rots identified were caused by *Phialophora malorum*, grey mould (*Botrytis cinerea*), *Alternaria mali*, *Cladosporium herbarum*, *Hormodendrum cladosporioides*, *Stemphylium congestum*, *Pleospora fructicola*, and fungi of the *Pullularia-Dematium* type, but none of these appear to cause serious losses. A fungus tentatively identified as *Dendrophoma* sp. was isolated from core rots and lesions surrounding insect stings; a species of *Sphaeropsis*, markedly different from *S. malorum*, from completely rotted apples; and a species of *Trichoderma* from a rot of Jonathan apples. The pathogenicity of these three species was proved in inoculation experiments.

Schmidt (M.). **Untersuchungen über die Biologie von Venturia inaequalis im Zusammenhang mit der Züchtung schorfwiderstandsfähiger Apfelsorten.** [Studies on the biology of *Venturia inaequalis* in connexion with the breeding of scab-resistant Apple varieties.]—*Forschungsdienst, Sonderh.* 16, pp. 498–506, 1942. [Abs. in *Gartenbauwiss.* (Ref.), xviii, 1, pp. 19–20, 1943.]

The available information concerning the most important aspects of the biology of apple scab (*Venturia inaequalis*) and its relation to its host is summarized [*R.A.M.*, xxi, p. 23]. Monoconidial and mono-ascospore cultures of the fungus, obtained by special methods directed towards the retention of full pathogenicity, revealed the existence of a multiplicity of forms differing mutually both in physiological and morphological characters. Such forms, many of which may colonize a single tree irrespective of local and seasonal conditions, are genotypically stable and represent distinct races, as was proved by hybridization experiments. Physiologic specialization in *V. inaequalis* is conditioned by the interplay of a number of mendelian, probably polymerous genes. The occurrence of mutations was frequently observed.

The breeding of scab-resistant apples is further complicated by differing varietal reactions to the individual physiologic races, but Antonowka, Ernst Bosch, and their progeny withstood infection by a number of the latter and were barely attacked in the orchard. The above-mentioned hybridization tests showed this specific capacity for parasitization to be also genotypic. In conclusion, a defensive reaction in the host tissues of resistant varieties was demonstrated by histological methods.

Wallace (T.), Ogilvie (L.), & Swarbrick (T.). **Two virus diseases of tree fruits.** —*Gdnrs' Chron.*, Ser. 3, cxvi, 3016, pp. 140–141, 2 figs., 1944.

Notes are given on the occurrence in England of the American virus diseases pear stony pit [*R.A.M.*, xxii, p. 213] and apple mosaic [ibid., xxii, p. 438], both of which have been transmitted by grafting at Long Ashton.

Pear stony pit is characterized by distorted, dimpled, deeply pitted fruits. The pits are irregularly shaped and show masses of stone cells at the base, which is deep green, in contrast with the more raised portions, which are rather pale. Size

is frequently much restricted, and the fruits often fall prematurely. Cut across, severely affected fruits show internal brown, stony areas. The fruits are mostly uneatable. Leaf and bark symptoms have not been observed in England. In the authors' experience, the most commonly affected variety is Doyenné du Comice, but the condition has also been noted on Pitmaston Duchess (severely), Durondeau (severely), Beurré Bedford, and Laxton's Superb. Injections of boron and iron into Comice and Pitmaston Duchess trees had no effect.

Grafts from affected Doyenné du Comice and Pitmaston Duchess trees on healthy Pitmaston Duchess gave stony fruits on the grafts, and, in the second season, on the originally healthy parts. After four years, the crops consisted mainly of stony fruits, though the ungrafted adjacent controls were normal. Grafts of one of these infected Pitmaston Duchess trees were placed on Doyenné du Comice trees and the following year the fruits on the grafts were stony, showing the disease had been carried over by grafting on to a second crop of trees.

In 1942, Lord Lambourne apple trees growing in Worcestershire showed a mosaic-like, irregular, yellowish to creamy-white leaf mottle. Scions grafted on to a healthy tree at Long Ashton gave rise to typically infected leaves. The condition is identical with apple mosaic as found in Canada and the United States.

Control of both conditions should be possible by eliminating affected trees and using grafts and buds from healthy trees only. Nurserymen should take every precaution regarding the source of scion material of susceptible varieties.

In recent years, two peculiar conditions affecting Lord Lambourne trees and characterized by 'chat' fruits and 'rubbery' wood have appeared in England, under conditions suggesting graft transmissibility. Conditions apparently identical with false sting [loc. cit.] (on the cider variety, Sweet Alford) and flat limb [loc. cit.] (very severe, on Lord Lambourne) have also been noted.

Overholser (E. L.), Overley (F. L.), & Allmendinger (D. F.). **Pear growing and handling in Washington.**—*Pop. Bull. Wash. agric. Exp. Sta.* 174, 84 pp., 21 figs., 1944.

In the section of this bulletin dealing with pear diseases (pp. 72–80), brief, popular notes are given on the symptoms and control of the principal parasitic, virus, and non-parasitic diseases affecting this crop in the western United States. Cottony cork of the Beurré d'Anjou variety is a relatively new disease. An internal fruit spot which appears as the pears mature, it originates near the stem end in the form of white, spongy areas. When affected fruits are cut open, only the healthy tissue develops rapid browning. This is a reliable diagnostic symptom.

Barnett (H. L.) & Bodine (E. W.). **Results of the brown rot survey, and notes on some other diseases of stone fruits in central California.**—*Plant Dis. Reptr*, xxviii, 6, pp. 181–183, 1944. [Mimeographed.]

During 1943, isolations from mummified fruits and twig infections in stone fruit orchards in central California, using for identification purposes the cultural characters of *Sclerotinia fructicola* and *S. laxa* described by Hewitt and Leach [*R.A.M.*, xviii, p. 533], showed that twigs of almond, apricot, peach, prune, plum, and *Prunus besseyi* yielded only *S. laxa*; in areas where peach is the dominant fruit grown, mummies yielded chiefly *S. fructicola*, whereas apricot, plum, and prune mummies yielded only *S. laxa*, except for one apricot and four prune mummies. Six isolations of *S. laxa* were made from nectarine mummies from two orchards in Contra Costa county.

Tranzschelia [*Puccinia*] *pruni-spinosae* was observed on green leaves remaining on almond trees in Monterey county in December, 1943, but when the orchards were revisited in February, 1944, no green leaves remained.

Wormald (H.). **Strawberry leaf blotch fungus.** *Gdnrs' Chron.*, Ser. 3, cxvi, 3018, pp. 160–161, 1944.

In the author's account of strawberry leaf blotch in Great Britain [*R.A.M.*, xxi, p. 86], the fungus was referred to as *Phyllosticta grandimaculans* Bubák & Krieger, 1912, but he now points out that in 1908 Laibach described what is undoubtedly the same organism as *Zythia fragariae* [ibid., xxii, pp. 32, 374]. It is now generally agreed that the fungus associated with the disease in England is a *Zythia*, from the colour of the fructifications, which are brownish (pale and yellowish in culture), and from the waxy consistency of the fruit body, and the conidial stage should therefore be called *Z. fragariae*.

In Britain, leaf blotch appears to have been first observed in November, 1931, on seedling strawberries at Long Ashton, though a fungus believed to be identical with *Z. fragariae* had been found on strawberry plants from Hereford in July of that year. The disease was next found in Kent, in 1939, while in 1942 it occurred in Worcestershire on the Huxley variety, adjacent Western Queen plants being unaffected. In July, 1944, infected Royal Sovereign leaves were received from Carnarvonshire, and in September of the same year leaves bearing the fungus were received from Hampshire and Norfolk. The disease has thus occurred so far in six counties of England and Wales.

When the fungus was grown in pure culture the *Zythia* stage appeared regularly, but in March, 1944, black, spherical perithecia with long necks developed in one culture tube. The ascospores measured about 10 to 12 by 2 μ and the fungus was found to be a *Gnomonia*. Later both conidial and perithecial forms developed in cultures from conidia and ascospores. In the present year both forms have been found on artificially infected leaves, from which the long neck protrudes like a brown or black bristle.

The perfect stage is very near to, and possibly identical with, *G. herbicola* described by Miss A. Lorrain Smith on the base of living stems of *Epilobium hirsutum* found in Derbyshire in 1908 and 1909. It is possible, therefore, that the strawberry fungus has other hosts. On strawberry and *Potentilla reptans* the fungus has been shown to be definitely parasitic. The disease is most common on the Royal Sovereign variety but has also occurred on Huxley's Giant.

Benlloch (M.). **Observaciones sobre algunas enfermedades del Olivo.** [Observations on some Olive diseases.]—*Bol. Pat. veg. Ent. agríc., Madr.*, xi, pp. 1–12, 8 figs., 1942. [Received August, 1944.]

Attention is drawn to the striking discrepancy between the symptoms induced by *Cycloconium oleaginum* on two olive varieties in Spain [*R.A.M.*, xxi, p. 403], viz., Nevadilla de Martos in Córdoba and Verdial in Málaga, much heavier damage being sustained in the former locality than in the latter, although the lesions on the foliage are considerably larger on Verdial than on Nevadilla. This apparent anomaly is attributed to differences in the climate of the two provinces.

Parasitic leaf 'scorch' was found to be associated with infection by *Macrophoma oleae* in one locality in Córdoba and with *Septoria oleae* in another. While this paper was going to press, a leaf sample from Posadas, in the same province, revealed the presence of *Stictis panizzei*, the most virulent agent of the disease in Italy [ibid., xvi, p. 546], which had not hitherto been detected in Spanish olive groves.

Generally speaking, *Gloeosporium olivarum* does not assume such a severe form in Spain as in Portugal [ibid., xxi, p. 496], but it may cause appreciable losses in a rainy autumn on late varieties. The extensive spread of 'knot' (*Bacterium* [*Pseudomonas*] *savastanoi*) is believed to be largely due to the use of apparently healthy but actually infected scions for grafting; growers should realize that the

pathogen may be harboured by any part of a diseased tree, not merely by the tumours themselves.

McNew (G. L.). **The use of fungicides during war.**—63 pp., 30 figs., 3 graphs, Chicago, The Canner Publishing Company, [1944].

This is a reprint of thirteen articles published by the author in *The Canner* during 1943 [cf. *R.A.M.*, xxii, p. 338], with the addition of a foreword, a seed treatment chart for vegetables, and a descriptive list of the fungicides discussed.

Officially approved insecticides and fungicides.—*J. Minist. Agric.*, li, 8, pp. 383–384, 1944.

A list is given of proprietary products officially approved for the control of plant pests and diseases and now added to the list previously published [*R.A.M.*, xxiii, p. 237].

Townsend (G. R.) & Heuberger (J. W.). **Methods for estimating losses caused by diseases in fungicide experiments.**—*Plant Dis. Reptr.* xxvii, 17, pp. 340–343, 1943. [Mimeographed.]

In estimating the effects of new fungicides against celery early blight (*Cercospora apii*) two methods of estimating the amount of disease present were compared, viz., scoring the plot as a whole, and classifying all the leaves from individual plants into categories based on the amount of disease present on each leaf.

The leaf-classification method proved very laborious and required the services of four persons for approximately six hours. Ten plants were selected at random from each plot. The leaves were separated and classified in six categories (0 to 5) indicative of the amount of blighted surface and ranging from no blight to leaves dead. The percentage of blighted foliage for each plot was then calculated from the formula $P = \frac{\text{Sum of } (n \times v)}{5N} \times 100$ where P = per cent. of blighted foliage, n = number of leaves in each category, v = numerical value of each category, and N = total number of leaves in sample. Dividing by $5N$ and multiplying by 100 gives the percentage of disease in terms of the maximum possible for the sample.

The plot-scoring technique enables one person to score 40 plots in under an hour. Accuracy depends on the experience of the observer, who should endeavour to classify the plot as a whole as it appears on close examination. The scale used ranged from 1 (trace of blight on lowest leaves) to 9–10 (topmost leaves blighted; foliage becoming chlorotic; lesions on the petioles). These scores are converted to per cent. of diseased foliage by multiplying each by 10.

A table is given showing the data obtained from 40 plots by each method, together with the correlation analysis. That both methods give equivalent results is shown by the mean values of 34·36 and 36·75 per cent. blight for the plot-scoring and leaf-counts methods, respectively, and by the high correlation co-efficient ($r = +0{\cdot}887$). It is concluded that the rapid, visual method of scoring the plot as a whole appears to be as accurate as more detailed methods for determining the amount of disease present.

Del Cañizo (J.). **Pulverización de Patatares y Remolachares (datos prácticos).** [Spraying of Potato and Beet fields (practical data).]—*Bol. Pat. veg. Ent. agríc., Madr.*, xi, pp. 359–374, 5 figs., 1942. [Received August, 1944.]

In this series of papers on the field spraying of economic crops in Spain, the writer has already dealt with the control of vine downy mildew [*Plasmopara*

viticola: *R.A.M.*, xx, p. 287] and fruit tree diseases (*Bol. Pat. veg. Ent. agríc., Madr.*, x, pp. 217–224, 1941). In the present contribution the author similarly discusses spraying apparatus and its use in the control of potato early and late blights (*Alternaria solani* and *Phytophthora infestans*) and beet leaf spot (*Cercospora beticola*).

Sardiña (J. R.). **La obtención de plantas resistentes a enfermedades.** [The development of disease-resistant plants.]—*Bol. Pat. veg. Ent. agríc., Madr.*, xi, pp. 43–96, 2 figs., 7 diags., 1942. [Received August, 1944.]

This is a fully documented, critical survey of some outstanding recent contributions to various aspects of the problem of breeding for disease resistance in plants.

Deighton (F. C.). **Diseases of cultivated plants in Sierra Leone.**—38 pp., Freetown, The Government Printer, 1943.

This useful annotated list of the diseases of cultivated plants in Sierra Leone [cf. *R.A.M.*, xvi, p. 208] is intended primarily for Agricultural Officers. The hosts are divided into four groups: (1) cereals, (2) plantation crops and fruit trees, (3) other crops, and (4) ornamentals, and are arranged alphabetically in each group, the ornamentals under their botanical names, the others in English. The notes provide information on the local distribution, symptoms, and control of the diseases.

James (W. O.). **An introduction to plant physiology. Fourth Edition.**—viii + 269 pp., 34 figs., 32 diags., 8 graphs, Oxford, Clarendon Press, 1943. 8*s.* 6*d.*

Developments in plant physiology during the past six years necessitated the revision and partial rewriting of this useful text-book.

Garrard (E. H.). **Disinfection and sterilization.**—*Food in Canada*, iv, 8, pp. 9–13, 4 figs., 1944.

This is a review of recent developments in the disinfection and sterilization of foodstuffs for the elimination of moulds, yeasts, and bacteria, among the methods discussed being the chemical treatment of walls, floors, etc., in packing plants, dairies, store rooms, and the like; sterilization by hot water, steam under pressure, or chlorination of utensils, vats, and containers; ozonization of the air; mists and sprays, of which hypochlorites appear to be particularly effective; acid detergents; ultra-violet radiation; and the natural preservatives inherent in certain products.

Elliker (P. R.). **A new quantitative method for estimation of total combined length of mold fragments in butter.**—*J. Dairy Sci.*, xxvii, 5, pp. 369–375, 1944.

The procedure herein described for the determination of total combined length of dead mould (*Oospora lactis*) fragments per mg. butter [*R.A.M.*, xxiii, p. 238 and next abstract] consists in the dilution of 1 gm. butter in a hot (70° to 75° C.) gum solution, spreading a small quantity on a glass slide, staining with Newman's reagent, and examination under low-power magnification. The average length of hypha per field is multiplied by the microscope factor divided by 1,000 and the results reported in mm. per mg. butter.

Elliker (P. R.). **Retention of mold fragments by butter, buttermilk and wash water during manufacture of butter.**—*J. Dairy Sci.*, xxvii, 7, pp. 563–569, 1944.

The total visible mould (*Oospora lactis*) hyphae count was determined on butter, buttermilk, and wash water of laboratory and commercial churnings at the Purdue Agricultural Experiment Station, Indiana [see preceding abstract]. The resulting

data indicated that butter usually retained over 50 per cent. (49 to 92 in five commercial samples) of the total length of hypha, whereas the wash water yielded a very low proportion (0·4 to 10·4), the figures for buttermilk (into which most of the minute hyphal fragments seemed to pass) being intermediate (7·2 to 40·6). In three laboratory samples the mould percentages in butter, buttermilk, and wash water ranged from 64·1 to 79·5, 18·7 to 35·3, and 0·5 to 1·8, respectively.

Whalley (Muriel E.). **Abstracts on penicillin and other antibiotic substances.**—71 pp., Ottawa, National Research Council of Canada, 1943. $1.00. [Mimeographed.]

These abstracts of papers on penicillin and other antibiotic substances are taken from *Amer. chem. Abst.* from 1917 to 10th September, 1943, inclusive, and other publications. They are arranged alphabetically according to authors, and an index of the antibiotic substances dealt with is provided.

Overholts (L. O.). **The fungistatic powers of Penicillium notatum.**—*Proc. Pa Acad. Sci.*, xviii, pp. 32–39, 1 fig., 1944.

Of the 29 decay- and disease-producing fungi grown in malt agar cultures in proximity to *Penicillium notatum*, only *Stereum frustulosum* exhibited an unusual degree of antagonism to the mould, the distance between the organisms after 17 days still ranging from 4 to 6 mm. A somewhat lesser degree of mutual aversion was observed between the mould and *Ceratostomella pilifera*, *Collybia velutipes*, *Endothia radicalis*, *Lenzites trabea*, *Morchella crassipes*, *Polyporus fissilis*, *S. hirsutum*, and *S. sericeum*.

Pontecorvo (G.) & Gemmell (A. R.). **Genetic proof of heterokaryosis in Penicillium notatum.**—*Nature, Lond.*, cliv, 3912, pp. 514–515, 1 fig., 1944.

Independently of Gladys E. Baker's work on the nuclear behaviour of *Penicillium notatum* [*R.A.M.*, xxiii, pp. 451, 494], the authors had also concluded that the older cells of the mycelium, the sterigmata, and the conidia are generally uninucleate, that the cells at the growing edge of the colony are usually multinucleate, containing up to a dozen nuclei each, and that hyphal fusions occur between branches of the same and different hyphae.

The fact that the conidia of *P. notatum* are uninucleate makes a genetic analysis possible. The technique is as follows: (1) production by X-rays of mutant strains, (2) mixed inoculation two by two of different mutant strains, and (3) search for non-mutant (wild-type) patches or for patches differing from either strain at the centre of the mixed colony and along the radii where the mycelia of the two strains are in contact. Mixed inoculation two by two of five such X-ray induced mutants, all characterized by a reduced pigmentation of conidia or by a complete failure to form conidia, gave the following results. All combinations of any two of four strains and none of the combinations involving the fifth (non-conidial) strain produced patches of mycelium with green conidia or with conidia differing from either of the strains used. When these conidia were plated out, the two component strains were recovered, confirming the fact that hyphal fusions and migration of nuclei from one strain to the other had taken place. Segregation of parental nuclei occurred at some stage between conidiophore and conidia formation.

Though each conidium carried a single nucleus, all those of one penicillus were of uniform pigmentation controlled by the constitution of the hypha from which the penicillus arose. If the criteria of genetics are valid in this case, then four of the five X-ray mutations tested behaved as if recessive. In the non-conidial mutation, failure to produce green conidia in mixed inoculi was probably due to dominance of the non-conidial effect. If this is confirmed, the high frequency

with which non-conidial mutants have been found, even without irradiation, is because of the dominance of their character.

Fernandez Valiela (M. V.). **Introducción a la fitopatología.** [Introduction to phytopathology.]—623 pp., 14 pl. (2 col.), 136 figs., 8 diags., 1 graph, 1 map, Federación Universitaria de Buenos Aires, Centro Estudiantes de Agronomía, 1942. [Received November, 1944.]

This valuable acquisition to phytopathological literature comprises the most complete account of plant diseases and cognate subjects hitherto published in the Spanish language. In addition to copiously documented up-to-date information on the incidence, geographical distribution (with special reference to Argentina), symptomatology, etiology, modes of perpetuation, economic effects, and control of numerous fungal, bacterial, virus, and physiogenic diseases, the treatise contains sections dealing with such general matters as the antecedents of phytopathology and its relation to other branches of science, the pathological changes induced by disease, the influence of environmental conditions, the classification of parasites and diseases, resistance and immunity (natural and acquired), and the like; the taxonomy and morphology of the bacteria and fungi concerned in the causation of plant diseases; the preparation and application of fungicides; and plant-protective legislation. An appendix furnishes instruction on the collection and transmission of specimens, the preservation of herbarium material, and the various regional phytopathological services at the disposal of Argentine farmers; and a host index is provided with a list of the diseases affecting each. Two useful charts are enclosed, one dealing with the classification of the fungi, and the other (partly coloured) with the symptoms produced by the cereal rusts and their organs of reproduction.

Downie (D. G.). **Notes on the germination of Corallorhiza innata.**—*Trans. bot. Soc. Edinb.*, xxxiii, 4, pp. 380–382, 1943.

Good though very slow growth of the orchid *Corallorhiza innata* was obtained in a medium of Pfeffer's nutrient salts plus potato extract inoculated with its symbiont, a member of the Basidiomycetes with septate hyphae and clamp-connexions described by Burgeff [*R.A.M.*, xvi, p. 115] as *Mycelium radicis* (*Corallorhiza*) *innatae*. The microscopic examination at the end of nine months of the cream-coloured, pear-shaped protocorms, measuring 0·2 to 1·6 mm., after treatment with lactophenol and cotton blue, revealed the entry of the fungus into the basal cells, where it had formed the characteristic 'pelotons' or coiled hyphal stages commonly found in endotrophic mycorrhiza.

Downie (D. G.). **Source of the symbiont of Goodyera repens.**—*Trans. bot. Soc. Edinb.*, xxxiii, 4, pp. 383–390, 1943.

Rhizoctonia goodyerae-repentis, the symbiont of *Goodyera repens* [cf. *R.A.M.*, xxii, p. 171], was isolated indirectly from the soil of a Scots pine (*Pinus sylvestris*) wood near Aberdeen, where it grows in the surface litter, but apparently does not survive in the older compact humus. Evidence is submitted for the presence of the fungus on the bifoliar spurs of the trees before shedding, a fact with an important bearing on the distribution of the symbiont in the soil and the colonization of the latter by the orchid. These observations appear to contradict Knudson's hypothesis that orchid seed germination under natural conditions is effected by the action of non-symbiotic saprophytic fungi on the organic substratum [ibid., vii, p. 387].

Mollison (Janet E.). **Goodyera repens and its endophyte.**—*Trans. bot. Soc. Edinb.*, xxxiii, 4, pp. 391–403, 7 figs., 1943.

Goodyera repens seeds sown on Pfeffer's nutrient medium inoculated with *Rhizoctonia goodyerae-repentis* [see preceding abstract] contract infection by the fungus

in the course of five days. Growth of the embryo begins immediately on the penetration of the suspensor cells by the hyphae and before the digestion of the fungus by its host, evidence of which is apparent 28 days after sowing. Asymbiotically germinated protocorms of the orchid, on transference to culture of the symbiont, become infected in 56 hours, digestion ensuing from the 14th day onwards.

The roots and rhizomes of adult plants in nature were found to be invariably infected by the symbiont. Evidence of successive infections of the host is demonstrated by the occurrence of interrupted zones of invasion in the rhizome. Reinfection of that organ takes place through the absorbing hairs, and each new root is infected by mycelium in the humus. A decline of vitality in the fungus after some length of time in the host is suggested in explanation of its failure to infect the meristems of the root apex and of the lateral buds and cells where chlorophyll is developed.

Macdougal (D. T.) & Dufrénoy (J.). **Mycorrhizal symbiosis in Aplectrum, Corallorhiza and Pinus.** —*Plant Physiol.*, xix, 3, pp. 440–465, 9 figs., 1944.

The results of a comparative study in California on the endophytic mycorrhiza of the orchids *Corallorhiza maculata* and *Aplectrum hyemale*, and on the ectendotrophic symbiont of the Monterey pine [*Pinus radiata*] are presented. In *A. hyemale* the stem-fungus association has induced a mutation involving the adjustment of the plants to the coralloid or mycorrhizal stem form anatomically similar to the nearly related *C. maculata*. The mycelium of the mycorrhiza of the last-named gains access to the cortex at an early stage; in its growth it keeps pace with the differentiating meristem, extruding branches through the epidermal cells of underground coralloid branches in simulation of the arrangement of root hairs. The non-parasitic character of the symbiont was established by various observations, including the absorption of inorganic phosphorus from the soil by the fungus and the stages of its metabolism terminating in the root stele, and the capacity of isolated segments of the mycorrhizal roots to survive and grow like a chlorophyll-less plant. The mycelium of the endophytic mycorrhiza, advancing towards the growing tip of the coralloid branches, forms dense swirls of hyphae enveloping the hypertrophied, densely granular nucleus. The hyphal masses disintegrate in the older portions of the stem and their contents become available to the still living cortical cells; further extension is barred by layers and islands of cells containing oxidized catechol. Both the fungus hyphae and the host cells are rich in mitochondria, the purpose of which has not yet been ascertained. Carbohydrate metabolism takes place mainly in the cortical cells. Auxins and vitamins are accumulated by, or originate in, the hyphae, whence they are translocated to the roots. Pads of material at the pores of the hyphal cross walls are thought to present analogies of composition and function with the sieve-plates of higher plants.

The pine-symbiont association does not appear to be connected with any heritable morphological alterations. The short lateral rootlets are invested directly by hyphal branches of the mycelia in the soil. The distribution of the hyphae in the cortex extends only as far as the endodermis in which catechol tannins are formed; the middle lamella of the outer cortex is traversed and its disintegration products are available for absorption. Palmated, branching hyphae enter the cortical cells and become closely intermingled with a minutely vacuolate cytoplasmic mass, suggestive of a mechanism of exchange. The phenolic compounds in the root pericycle and endodermis, on escape from the vacuoles, oxidize to tannin, which 'fixes' the protoplasm as seen in the brown peripheral layers of old mycorrhiza.

MacDougal (D. T.) & Dufrénoy (J.). **Study of symbiosis of Monterey Pine with fungi.**—*Yearb. Amer. phil. Soc., 1943*, pp. 170–174, 1944.

The mycorrhizal partner of the Monterey pine [*Pinus radiata*] in California [see preceding abstract], when actively penetrating the root tissues, gives an intense blue coloration with the molybdenum reagent indicative of bound phosphorus dissolved in the vacuolar solution. Reaction with paraphenylenediamine, resulting in the formation of indophenol blue, affords evidence of high oxidase activity in the ectendotrophic mycorrhiza. The production of indophenol blue with 2–6 dichloroquinone chloro-imide indicates an abundance of pyridoxin in the mycorrhiza, located principally in the outer hyphae in contact with the soil, and in the 'mantle'. It is the remobilization of pyridin derivatives from the soil by the symbiotic fungus, and their translocation by the latter to the root cells, that enables isolated root segments of the host to survive and develop.

McLean (J. G.) & Kreutzer (W. A.). **The determination of virus infections in the Potato tuber by the use of ultraviolet light.**—*Amer. Potato J.*, xxi, 5, pp. 131–136, 1944.

The possibility of reducing the amount of virus infection in potatoes by examining the seed tubers in ultra-violet light prior to planting and discarding those showing fluorescence was investigated in the following way. The authors examined the cut surfaces of more than 1,000 Bliss Triumph tubers under an H–4 type mercury vapour lamp at 40° F. and classified them on the basis of the intensity (none, low, moderate, or intense), location (in the vascular ring, diffuse throughout the tuber, or in the cortex), and colour (white or yellow) of their respective fluorescence. The tubers were then planted and the resulting plants examined at weekly intervals, from emergence to maturity, for virus symptoms. The results showed that as the intensity of fluorescence increased there was a decrease in healthy plants in the field from 30·7 per cent. to nil, and a corresponding increase in the amount of leaf roll. Yellow fluorescence in the vascular ring generally indicated spindle tuber, and white fluorescence leaf roll. When fluorescence was observed in the vascular ring the only mosaic which appeared was one in combination with spindle tuber. Diffuse fluorescence indicated, for the most part, mosaic or combinations of mosaic and spindle tuber, although a few plants infected with only spindle tuber also appeared in this group. Out of 14 tubers with cortical fluorescence, 13 produced plants infected with rugose mosaic.

It is suggested that the outlined method may be used with reasonable accuracy in foundation and tuber-unit seed plots, and even possibly in the laboratory for disease identification and to supplement tuber-indexing.

Pailthorp (R. R.). **War approved seed Potatoes in 1944.**—*Amer. Potato J.*, xxi, 5, pp. 136–139, 1944.

The following minimum requirements for seed potatoes produced in 1944 serve as a basis for approval of State specifications by the War Approved Seed Potato Committee of the United States Department of Agriculture. At the time of any field inspection by the State Agency, the field shall not show more than 5 per cent. each of leaf roll, mosaic, and spindle tuber; 2 per cent. yellow dwarf; 3 per cent. other virus; 5 per cent. each of witches' broom, 'hay wire' [*R.A.M.*, xvi, p. 490], giant hill, rosette, spinach leaf, and curly dwarf, the total for all six not exceeding 7 per cent.; 1 per cent. varietal mixture; 5 per cent. purple top wilt [aster yellows virus]; late blight [*Phytophthora infestans*] not above a limit at which observation of other diseases becomes impossible; $\frac{1}{4}$ per cent. bacterial ring rot [*Corynebacterium sepedonicum*]; and no potato wart [*Synchytrium endobioticum*] or nematodes. All potatoes must be subjected to a final pack inspection, at which they shall show

no more than 2 per cent. each of spindle tuber (visible) and late blight (any degree); 1 per cent. each of soft rot or wet breakdown (any degree) and varietal mixture; 5 per cent. each of deep pitted scab [*Actinomyces scabies*] (damage, interpreted according to the U.S. Standards for Potatoes) and hair sprout (any degree) [ibid., xxiii, p. 454]; 6 per cent. stem-end discoloration (serious damage); 0·1 per cent. ring rot (any degree); and no potato wart or nematodes.

Dykstra (T. P.). **Potato production problems in China.**—*Amer. Potato J.*, xxi, 5, pp. 123–131, 1944.

The author, assigned by the American State Department to help Chinese specialists in establishing a national potato programme, gives this first report on his work at the National Agricultural Research Bureau at Pehpei, near Chungking, Szechwan, since 1942. An examination of plants grown from the 8,000 tuber indexes taken at random from practically every important potato-growing province in Free China (Szechwan, Yunnan, Kweichow, Honan, Hupeh, Shensi, and Kansu) showed that practically 100 per cent. of them had virus infection (mainly leaf roll but also rugose mosaic, mild mosaic, and spindle tuber), indicating the prevalence and seriousness of virus diseases in China. None of the lots could be used as a source of virus-free seed. The inspection of the potato-growing district of Penghsien, Szechwan, involving about 25,000 acres, showed that almost all plants were infected with leaf roll, and many with rugose mosaic, aphids, apparently *Myzus persicae*, being commonly found on potato foliage. The only exception in the district was one small field near the top of a mountain which was completely free from virus disease. It was learned that the owner of this field had been saving his own seed for over 10 years. The entire crop from this field was bought up to be used next year as seed potatoes. A survey of the Kweichow Province in south-western China, including the ideal potato country in the region of Weining, showed practically 100 per cent. of the plants to be infected with leaf roll and several plants were found with typical witches' broom. However, a few fields were almost completely free from virus diseases and arrangements were made to buy up healthy and nearly healthy seed potatoes of the three local varieties. In north-western China, where the acreage devoted to potato-growing is increasing every year, the potato being a major crop and providing the main diet for more than 50 per cent. of the population, it was found that not a single field was free from virus infection. Leaf roll was predominant, but occasionally severe rugose mosaic was observed and spindle sprout was found frequently. Late blight [*Phytophthora infestans*], first observed in early August, had become epidemic by late September, potatoes planted without ridging and in some cases with only 1 ft. between the rows providing ideal conditions for the development of the disease.

For the whole of the country, the aggregate annual reduction in yield caused by leaf roll alone is stated to amount to several million bushels. It is planned to purchase virus-free fields and to plant potatoes as tuber units next year in the same area and the following year in a larger area with a view to distributing disease-free seed potatoes to the growers of table stock as soon as sufficient quantities have been accumulated. It is believed that the yield per unit area could be doubled by growing disease-free seed of varieties commonly found in China. Of 52 American varieties now being tested Sebago, if adapted to the north-west, may become the major variety of the region because of its resistance to late blight.

Starr (G. H.). **Hot water for the control of Potato ring rot bacteria on the cutting knife.**—*Amer. Potato J.*, xxi, 6, pp. 161–163, 1944.

In tests conducted during 1942 and 1943, it was shown that knives used in cutting potato seed pieces and responsible for much spread of bacterial ring rot

(*Corynebacterium sepedonicum*) [*R.A.M.*, xxiii, p. 275] can be made sterile by the use of boiling water. The following test was made: the knife was drawn through ring rot-infected tubers and then immersed in hot water held at various temperatures (between 150° and 200° F. for periods of 5, 10, or 15 seconds); it was then removed and used to cut healthy tubers in halves, repeating the immersion before each cut. The seed pieces obtained were planted out and the plants inspected for ring-rot symptoms several times during the season, as well as stem smears on slides made for subsequent staining and microscopic examination. The results showed that a power-driven rotary knife may be sterilized by continuously running in a vat of boiling water ('200°') and ordinary knives by dipping them in boiling water for 10 seconds. Temperatures lower than boiling point were not effective, no control whatever resulting at 150°, and five seconds' immersion proved insufficient. No reduction in stand or vigour of the resulting plant was observed to follow the use of a hot knife.

Gilmore (L. E.) & Robinson (C. H.). **Studies in seed Potato treatments. III. Agencies and practices that reduce the strength of mercuric chloride solutions, causing ineffective disinfection. IV. The repeated use of corrosive sublimate solutions by strength-control and by acidulation with acetic acid for effective disinfection practice.**—*Sci. Agric.*, xxiv, 8, pp. 351–357, 358–365, 1944.

Continuing their studies on mercuric chloride solutions used for seed potato treatments [*R.A.M.*, xxii, p. 448] the authors found that for the standard long soak used in Canada (1½ hours in 1 : 1,000 solution) it appears to be conclusive that sacks, crates or hampers, soils, and vessels with metal parts that come into contact with the solution rapidly render it useless, possibly owing to both chemical reduction and physical adsorption; for instance, dirty used sacks effected a loss of 15 to 45 per cent., washed sacks 6 to 28 per cent., 1 lb. soil to 5 l. solution 11 to 30 per cent., washed potatoes 3 to 11 (average 5·6) per cent., and wooden vessels 0·5 to 3·8 per cent. Well-water of good drinking quality and the reducing substances in the tubers (if cut tubers are eliminated) are of negligible effect. The following recommendations are made: (1) use concrete, porcelain, or wooden vessels; (2) do not treat potatoes in sacks, or in crates or hampers held together with wire or nails; (3) remove soil and vegetable matter from the tubers, preferably by soaking, before treatment; and (4) test and adjust the strength of the solution according to the authors' method [loc. cit.] before treating each lot of tubers.

In the second paper it is shown that the strength of mercuric chloride in nine successive treatments of washed potatoes was reduced by less than 6 per cent. per treatment when the authors' method of testing and adjusting was used.

If the standard long soak is considered unsatisfactory, an acidulated treatment may be substituted. Twenty successive lots of unwashed potatoes were treated (10 minutes each) in a wooden vessel containing 2 gm. mercuric chloride and 16·7 ml. glacial acetic acid per l. without need of adjustment of any kind, a total of less than 10 per cent. mercuric chloride and 5 per cent. acetic acid being lost at the end of the experiment. Sacks, crates, hampers, soil, and refuse must also be kept out of the acidulated solution, but the tubers need not be washed. A considerable saving in labour and material costs is possible by the use of the acidulated treatment.

Progress of Potato late blight.—*Plant Dis. Reptr*, xxvii, 16, pp. 302–307; 17, pp. 382–387; 18, pp. 419–423, 1943. [Mimeographed.]

Tables are given showing the areas where mean temperatures were favourable (up to 78° F.) or unfavourable (above 78°) to the spread of potato late blight (*Phytophthora infestans*) in different parts of the United States at weekly intervals

during the period 17th August to 14th September, 1943, followed by reports from the different States on the prevalence of infection.

Trials of Potatoes for immunity from wart disease.—*J. Minist. Agric.*, li, 8, pp. 382–383, 1944.

A descriptive list is given of new potato varieties added to the list of approved varieties found in trials by the Ministry of Agriculture to be immune from wart disease [*Synchytrium endobioticum*: *R.A.M.*, xx, p. 30], viz., Home Guard, Strathearn Early (early), Stormont Dawn, Ulster Cromlech, Dr. McIntosh, and Ulster Early (early maincrop).

Rieman (G. H.), Tottingham (W. E.), & McFarlane (J. S.). **Potato varieties in relation to blackening after cooking.**—*J. agric. Res.*, lxix, i, pp. 21–31, 1 pl., 1944.

Twenty-three potato varieties and strains grown for five years in nine widely separated localities in Wisconsin showed consistent differences in the amount of blackening that developed after boiling [*R.A.M.*, xxiii, p. 76]. Triumph and Chippewa showed only half as much blackening as Rural New Yorker and Russet Rural. Eight named varieties developed through clonal selection behaved similarly to their parent varieties.

The white-cooking tendencies presented by the closely related Chippewa, Katahdin, and Sebago varieties suggest that they carry genetic factors for white tuber flesh after boiling. The behaviour of F_1 progenies from Katahdin and Sebago crossed with dark-cooking Hindenburg supports this assumption. White tuber flesh after cooking was dominant or incompletely dominant to grey tuber flesh after cooking. Parent types were easily recovered among 267 F_1 individuals, indicating simple factorial interactions for after-cooking blackening. Segregation in the F_1 generation demonstrated heterozygosis in the parent stocks.

Evidently, the dark-cooking character is inherited. Climatic factors had a marked influence on the formation of substances in potato tubers that darken after boiling, but soil type and fertility had only a limited influence. Storage conditions had a strong effect on blackening.

Daines (R. H.). **Borax dip of Sweet Potatoes safened by the use of calcium salts on the bedding soils.** *Plant Dis. Reptr*, xxviii, 8, p. 312, 1944. [Mimeographed.]

Serious boron poisoning may be caused by the otherwise effective treatment for the control of sweet potato black rot [*Ceratostomella fimbriata*] consisting of a ten-minute soak before bedding in a borax solution (1 lb. in 5 gals. water). At the New Jersey Agricultural Experiment Station, for example, up to 30 per cent. of the sprouts arising from boron-treated roots have shown toxicity symptoms, of which the most prominent is a darkening of the veins near the leaf margins, sometimes extending to the midrib and rapidly destroying the tissues within the affected area. This form of injury was found to be largely preventable by the admixture with the bedding sand of small quantities of calcium salts, e.g., ½ lb. lime or 1 lb. gypsum per 100 sq. ft.

Allen (P. J.), Naghski (J.), & Hoover (S. R.). **Decomposition of Guayule resins by microorganisms.**—*J. Bact.*, xlvii, 6, pp. 559–568, 1944.

At the Eastern Regional Research Laboratory, Philadelphia, the authors studied the occurrence of resin-decomposing organisms during the retting of guayule (*Parthenium argentatum*) shrub by the natural microflora. A method is described for the detection of such organisms by their ability to cause clearing of resin emulsions suspended in agar. Among those identified were *Actinomyces fradii*, *Aspergillus*

fumigatus, *Rhizopus arrhizus*, and one of the Dematiaceae. All the organisms were found to attack some portion of the crude rubber extract, but the unsaponifiable fraction contains compounds utilized only by *Actinomyces fradii* and the Dematiaceous fungus, the latter also digesting the exuded resin. The rate and extent of clearing of resin-agar emulsions by the organisms was shown to be correlated with resin decomposition in liquid culture.

Salmon (E. S.). **Four seedlings of the Canterbury Golding.**—*J. Inst. Brew.*, N.S., xli, 5, pp. 244–250, 4 figs., 1944.

Descriptive notes are given on four seedlings raised from the Canterbury Golding hop by crossing it with pollen from a male plant of Brewer's Gold at Wye College, Kent, in 1934. One of them, designated Southern Brewer (WFA 111), is susceptible to mosaic, while the remaining three, viz.: Northern Brewer (WFB 135), John Ford Hop (WFA 90), and Wye Field Golding (WFC 81), are apparently immune from the disease though infected.

Wilson (J. D.) & Runnels (H. A.). **Fixed coppers to control Ginseng blight.**—*Bi-mon. Bull. Ohio agric. Exp. Sta.*, xxix, 228, pp. 135–144, 1944.

As a result of further experiments in the control of ginseng blight (*Alternaria panax*) in Ohio [*R.A.M.*, xvii, p. 447], where the disease occurs in a semi-epidemic form nearly every year, it is recommended that spraying should commence as soon as most of the plants have emerged in early May, and be continued at fortnightly intervals until about three weeks after bloom, six or seven applications being involved by this schedule in the average season. Bordeaux mixture (6–6– or 8–8–100) plus calcium arsenate (4 lb.) was the most effective of the copper-containing fungicides tested, and should be preferred to the fixed coppers under ordinary conditions; it is, however, liable to injure the stands in wood-lot plantings during spells of drought and should be replaced in such situations, e.g., by copper A [ibid., xxiii, p. 74] with the addition of calcium arsenate and flour or bentonite (4–4–4–100). The admixture of a good wetting agent, such as Grasselli spreader and sticker (1 in 1,600), is advisable in all cases.

Asthana (R. P.) & Mahmud (K. A.). **Tip-burn of Piper betle in the Central Provinces.**—*Curr. Sci.*, xiii, 9, p. 234, 1 fig., 1944.

Piper betle in the Central Provinces sustains considerable damage from tipburn during the hot weather (about the end of March to the middle of May), varieties with a thin, soft foliar texture, such as Kapuri, being particularly susceptible. Wilting originates at the extreme tip of the leaf and sometimes extends right round the margin; later the affected tissues turn brown and undergo necrosis, eventually becoming hard and brittle, so that they are readily broken or torn. Diseased leaves do not fall, but remain attached to the vines in a flaccid condition, differing in this respect from those attacked by fungi or bacteria. Tipburn is caused by excessive loss of moisture from the foliage under the influence of heat, while a contributory factor to mortality from the disturbance is the poor root system associated with infection by *Phytophthora parasitica* var. *piperina* [*R.A.M.*, xxiii, p. 457]. Proper shading and irrigation of the gardens during the critical period should reduce the incidence of tipburn to a minimum.

Inniss (B. de L.). **Sugar-Cane mosaic disease in Jamaica and Barbados.**—*Bull. Brit. W. Ind. centr. Sug. Cane Breed. Sta.* 26, pp. 12–21, 1944.

In some areas of Jamaica, sugar-cane mosaic [*R.A.M.*, xxii, pp. 78, 352] can be controlled by the systematic roguing of susceptible varieties, whereas in others, although roguing is practised, effective control has not yet been secured. To control the disease on an estate where no control methods have been practised or

where they have been found impracticable, the windward side should be planted to resistant or immune varieties, which should be worked right across the estate. When the fields first planted on the windward side are to be replanted, disease-free material of the desired susceptible varieties can be used.

A table is given, based on observations made on sugar estates and on mosaic disease trials at Hope, giving the seedlings sent to Jamaica from the British West Indies Cane Breeding Station, with their parentage, derivation, and reaction to mosaic. From this it appears that the vast majority of noble canes are highly susceptible, as are the Celebes and Chunnee 'nobilizations', while derivations of the Local form of *Saccharum spontaneum* when crossed with Chunnee 'nobilizations' appear to produce susceptible seedlings. In the Glagah line of 'nobilization', however, there is an almost 2 to 1 ratio in favour of resistance. Seedlings with Glagah 'blood' appear to be even more resistant. The seedlings of purely Glagah 'nobilization' produced by the Station have not been so successful commercially as those of Local and Chunnee 'nobilizations', though very few of the latter have shown resistance. The policy to follow in breeding seedlings for Jamaica is to combine the resistant Glagah 'blood' of *S. spontaneum* with the susceptible 'blood' of the Local form of the same species or that of *S. barberi* Chunnee, or both. This policy is being carried out.

Of the newer seedlings, B. 34104 seems the most promising locally. It possesses a wide range of adaptability, good juice, and exceptionally strong ratooning powers. Though very susceptible, it should be planted extensively on estates where the disease is under control or where clean material can be obtained for all new plantings. B. 3439 is highly resistant in Jamaica; the few stools that do contract the disease develop such severe symptoms that they can readily be detected; they should be at once removed. B. 37161 shows slight resistance in Jamaica, while infected stools appear to be tolerant. B. 37193 is resistant, but has not been tried on a large scale. B. 37172, B. 38155, and B. 38212 are resistant, but are still in testing or multiplication stages.

Johanson (Alfhild E.). **An endo-operculate Chytridiaceous fungus: Karlingia rosea gen. nov.**—*Amer. J. Bot.*, xxxi, 7, pp. 397–404, 37 figs., 1944.

Karlingia rosea (*Chytridium roseum* De Bary & Woron.) comb. nov. occurs as a saprophyte in damp, rich soil in Germany, the Galapagos Islands, and various parts of the United States, and as a weak parasite on *Equisetum arvense* spores in France. It also makes luxuriant growth on air-dried onion skins, boiled, dechlorophyllized maize leaves, grass, and cellophane, imparting to these substrata a conspicuous rosy tinge. The cytology and morphology of the Chytrid are described at length.

Bisby (G. R.). **Nomenclature of fungi.** *Mycologia*, xxxvi, 3, pp. 279–285, 1944.

As a basis for discussion, the writer comments on interpretations of the two articles, in the International Rules of Botanical Nomenclature, which deal particularly with fungi, and gives examples of actual or proposed usage.

Stevenson (J. A.). **A preliminary list of authors of plant parasites with recommended abbreviations.** *Plant Dis. Reptr*, xxviii, 11, pp. 366–395, 1944. [Mimeographed.]

In connexion with F. Weiss's revision of the 'Check List of Diseases of Economic Plants in the United States', which appeared in instalments in *Plant Dis. Reptr* between 15th April, 1940 (xxiv, 7), and 15th January, 1943 (xxvii, 1), the writer has compiled a very useful list of recommended citations for the names of the authors of plant parasites recorded therein, with contractions, where indicated.

based on Recommendation XXX of the International Rules of Botanical Nomenclature. In addition to the full names of the authors, totalling between 1,400 and 1,500 (mostly mycologists), the years of birth and death (where applicable) are furnished wherever available.

De Rezende Pinto (M. C.). **Hymeniales de Portugal.** [Hymeniales of Portugal.] – *Brotéria*, xi, 1, pp. 1–16; 2, pp. 62–80; 3, pp. 106–136, 1942; xii, 1, pp. 1–20; 2, pp. 58–75; 3, pp. 116–127; 4, pp. 180–190, 1943; xiii, 1, pp. 25–36; 2–3, pp. 131–140, 1944.

This is a critically annotated list (not yet complete) of some 865 Hymenomycetes collected in Portugal up to the end of 1940. The author's foreword is supplemented by tables (based on Saccardo's 'Flora italica cryptogama') showing the total number of genera and species in this group to be 106 and 1,110, respectively, in Portugal, as compared with 123 and 2,331, respectively, in Italy.

Mundkur (B. B.). **Fungi of the Northwestern Himalayas: Ustilaginales.**—*Mycologia*, xxxvi, 3, pp. 286–293, 1 fig., 1944.

This list of 21 smuts, including two species new to science and five new to India, is based on collections made in the north-western Himalayas by R. C. and I. D. Stewart.

Coe (D. M.). **Variations in single ascospore isolates of Sclerotinia sclerotiorum.**—*Mycologia*, xxxvi, 3, pp. 234–241, 3 figs., 1944.

In preliminary studies carried out at the Washington State College between 1940 and 1942, the author observed considerable variation in appearance of the 31 single ascospore cultures from an isolate of *Sclerotinia sclerotiorum* [*R.A.M.*, xxii, p. 240] from cucumber. The cultures could be readily divided into two groups: 14 of them resembled in every respect the parent isolate and are designated as the N or normal type, and 17 as the A or aberrant type. The latter exhibited a much slower radial growth, averaging 60 mm. in diameter after five days on potato dextrose agar at 19° to 20° C., whereas the N type cultures, grown under identical conditions, had all by then reached the edge of the Petri dish (90 mm.): after ten days sclerotia had just begun to form in the A type cultures, whereas they were nearing maturity in the N type. The mycelium of the A type was distinctly more cottony than that of the N type and formed such dense mats as to exclude light, the cultures assuming a definite brown colour at the agar surface. The sclerotia produced in these, and in the giant oat cultures, were fewer and more irregular in shape in the A than in the N type, and also showed a tendency to be flattened and depressed on the upper side in contrast to the domed shape of the N-type sclerotia. The bulk of sclerotia from the N-type cultures was approximately four times greater than from the A-type of the same age. When planted in separate sand cultures in the greenhouse, both types of sclerotia began their apothecial production at about the same time, but whereas the total numbers of apothecia produced by the N-type sclerotia ranged from 854 to 1,421, those produced by the A type ranged from 35 to 229. The N-type apothecia were indistinguishable from those produced by the original parent isolate. Macroscopically, the apothecia of the two types were more different than those of *S. sclerotiorum* and *S. trifoliorum*; those of the A type were dark, soft, and watery, while those of the N type were lighter in colour and firm and wax-like in texture. Under the microscope, the crushed hymenial tissue of the A-type apothecia exhibited a high ratio of paraphyses to asci in comparison with the N type, the asci and ascospores of the former being more irregular in outline, although similar in size. The average measurements of ascospores and asci were: for the N type 12·61 by 6·63 μ and 135·99 by 8·06 μ, respectively, and for the A type 12·30 by 6·89 μ and 134·76 by

7·91 μ, respectively. The second-generation single ascospore isolates from both types grown under the same experimental conditions corresponded exactly to the parent cultures.

The discovery of distinct morphological types in *S. sclerotiorum* is taken to indicate that, although this fungus is homothallic for sex, it may be subject to segregation for other characters. It is pointed out that the A type has never yet been isolated directly from diseased plant material, which may indicate either that this type is incapable of parasitism, that a sexual union by anastomosis occurs, or that the microconidia of *S. sclerotiorum* do have a sexual function.

Davidson (R. W.). **Two American hardwood species of Endoconidiophora described as new.**—*Mycologia*, xxxvi, 3, pp. 300–306, 2 figs., 1944.

Comparisons of cultures of *Endoconidiophora coerulescens* from Europe, obtained from the Centraalbureau voor Schimmelcultures, with American isolates of this fungus [*R.A.M.*, xix, p. 315], revealed consistent and significant differences. The American fungus, commonly found on green sapwood of hardwood logs and lumber in southern United States, from Virginia to Florida and Louisiana, is therefore described as a new species, *E. virescens*. It differs from the European fungus in that it is chiefly confined to hardwoods, gives off a distinctive musty odour, and some of its conidiophores have a smaller diameter at the tip. Another related species, found causing a grey mould on chestnut oak (*Quercus montana*) tanbark in West Virginia, is described as *E. variospora* n.sp.

Jenkins (W. A.). **An appraisal of downy mildew as a factor in field losses of bright Tobacco in Virginia during the 1943 season.**—*Plant Dis. Reptr*, xxvii, 16, pp. 298–299, 1943. [Mimeographed.]

Attention is drawn to the correlation existing between the losses sustained in late crops of bright tobacco in Virginia in 1943 and the epidemic of downy mildew [*Peronospora tabacina*] which was responsible for the planting of these late crops. The losses in question ranged from 20 to 50 per cent., mainly in quality, representing a reduction in profit of $50 to $150 per acre, exclusive of losses from black shank [*Phytophthora parasitica* var. *nicotianae*] and Granville wilt [*Xanthomonas solanacearum*]. Many growers were forced, owing to the epidemic, to replant their crops several times, and, almost without exception, the percentage of mosaic transplants increased with each additional replanting.

Wilson (J. D.). **Tomato fruit drop, caused by early blight.**—*Plant Dis. Reptr*, xxvii, 20, p. 555, 1943. [Mimeographed.]

Early blight of tomato (*Alternaria solani*) was unusually severe in Ohio in 1943, causing an exceptionally high incidence of pedicel infection, which resulted in a shedding of up to 30 per cent. of the affected fruits, often at only a quarter or a third of their normal size. In one plot at the Agricultural Experiment Station, only 7 per cent. of the fruits from plants sprayed with a fixed copper plus calcium arsenate were abscissed at picking time, compared with 35 per cent. in the untreated controls [cf. *R.A.M.*, xxiii, p. 82].

Éire. Report of the Minister for Lands on Forestry for the period from 1st April, 1938, to 31st March, 1943.—65 pp., (?) 1944.

The following items of phytopathological interest occur in this report (pp. 33–34). Spraying of larches against *Meria laricis* [*R.A.M.*, xv, p. 761] was continued, but no serious attacks were reported. Oaks and other broad-leaved trees in a few nurseries suffered from mildew [? *Microsphaera quercina*], and *Rosellinia* was also present in one locality. *Adelopus* [*Phaeocryptopus gaeumanni*] occurred in two forests on Douglas fir [*Pseudotsuga taxifolia*], and rather severe infection by

Nectria on ash in another place. The honey fungus [*Armillaria mellea*], however, is the most troublesome fungal pest, especially on Sitka spruce [*Picea sitchensis*] on recently cleared areas, having been recorded in 14 forests during the period under review.

WRIGHT (E.). **Damping-off in broadleaf nurseries of the Great Plains region.**—*J. agric. Res.*, lxix, 2, pp. 77–94, 4 figs., 1 map, 1944.

The results of recent field and laboratory studies conducted in the 17 Federal hardwood nurseries of the Great Plains region of the United States showed that broad-leaved seedlings suffer from pre- and post-emergence damping-off, the former causing the destruction of the seed or the new radicle and thus preventing emergence, and the latter affecting seedlings from a few days to three weeks old and which may cause considerable losses. The affected seedlings may fall over on the ground or, more commonly, remain upright and later dry up and break off. Losses from this type of damping-off are seldom large within 24 hours but over a period of ten days may amount to from 20 to 35 per cent. of the stand. Sore shin, characterized by a reddish-brown lesion on the stem near the ground, is regarded as a phase of post-emergence infection; it is quite common and stunts seedlings two to four weeks old but is seldom fatal. Root rots and top infection of young seedlings are stated to be unimportant in this region. Only about half the hardwood species studied proved susceptible to damping-off, the most important being *Ulmus americana* and *U. pumila*, *Robinia pseud-acacia*, and *Chilopsis linearis*; these may suffer damping-off losses ranging from 10 to 60 per cent. The most important resistant species, for which control measures were unnecessary, were *Fraxinus pennsylvanica* var. *lanceolata*, *Catalpa speciosa*, *Celtis occidentalis* and *C. reticulata*, *Gleditsia triacanthos*, *Quercus macrocarpa*, and *Prunus virginiana*.

Isolations from diseased seedlings yielded chiefly *Rhizoctonia* [*Corticium*] *solani* (in the imperfect state and showing strain differences) and *Pythium ultimum*, but occasionally *Fusarium* spp. [unidentified] also. *Robinia pseud-acacia* appeared to be more frequently attacked by *P. ultimum* and *Chilopsis linearis* by *C. solani*. Soil inoculation tests showed that *P. ultimum* and several strains of *C. solani* are pathogenic to a number of broad-leaved species as well as to wheat, maize, and lucerne. Generally, pre-emergence losses among hardwoods from *P. ultimum* were greater in sterilized than in unsterilized soil, whereas *C. solani* was more effective in unsterilized soil. On the other hand, for post-emergence damping-off the percentage loss was greater when *P. ultimum* was inoculated into unsterilized soil and *C. solani* into sterilized soil. Preliminary tests with *F.* spp. indicated that these fungi may cause fairly heavy post-emergence damping-off in unsterilized, inoculated soil but very little pre-emergence infection except in sterilized, inoculated soil. With regard to control it is pointed out that, because of the uniformity of climatic and soil conditions prevailing throughout the region, all measures recommended would be applicable to the entire area. Since some soils showed heavier damping-off potentialities than others, only resistant species should be grown on such unfavourable sites, and susceptible species should not be grown in areas occupied during the preceding season by other susceptible hosts.

HONEY (E. E.). **Tree diseases observed in Wisconsin.**—*Plant Dis. Reptr*, xxviii, 6, pp. 172–180, 1944. [Mimeographed.]

This is an annotated list of diseases of conifers and hardwoods observed in Wisconsin during 1943, special mention being made of decay organisms.

POMERLEAU (R.). **Observations sur quelques maladies non parasitaires des arbres dans le Québec.** [Observations on some non-parasitic diseases of trees in Quebec.]—*Canad. J. Res.*, Sect. C, xxii, 4, pp. 171–189, 4 pl., 1944.

The author gives short notes on non-parasitic diseases of trees in Quebec, such

as galls of birch (*Betula papyrifera*), witches' broom of *Acer negundo*, various malformations of *B. lutea*, *B. papyrifera*, and *Picea glauca*, heartwood discoloration of *A. saccharum*, and fasciation of *Prunus pennsylvanica*, all of which are of unknown origin. Winter frosts are stated to be harmful to many broad-leaved as well as coniferous species, but still greater damage, particularly to *A. saccharum*, is caused by fluctuating temperatures and exposure to sunlight in the spring. Other causes of disease are excessive heat and drought, floods, malnutrition, harmful factory fumes, and dust.

Walter (J. M.). **Wound dressing for London Plane trees.**—*Plant Dis. Reptr*, xxviii, 10, p. 356, 1944. [Mimeographed.]

The fungus responsible for canker stain of London plane [*Platanus acerifolia*] trees, a species of *Endoconidiophora* very closely related to *E.* [*Ceratostomella*] *fimbriata*, may survive for several days in the commonly used brands of asphalt tree wound paints contaminated by infected sawdust, fragments of bark and wood, or spores of the organism [*R.A.M.*, xx, p. 611]. In experiments in New Jersey, this prevalent mode of spread of the pathogen was obviated by the thorough admixture with wound dressings, of the gilsonite varnish type only, of 0·2 per cent. phenyl mercury nitrate. No infections resulted from inoculations with contaminated paint treated in this way, whereas the same material without the disinfectant chemical caused 90 to 100 per cent. infection.

Pontis Videla (R. E.). **El 'mal de la tinta' del Nogal en la República Argentina.** [The 'ink disease' of the Walnut in the Argentine Republic.]—*Rev. B.A.P.*, xxvii, 313, pp. 31, 33, 2 figs., 1943.

Attention is drawn to the prevalence on walnuts in Argentina of the ink disease, attributed by the author to *Phytophthora citrophthora*, the agent of citrus gummosis or foot rot [*R.A.M.*, xxi, p. 195]. The disease, which occurs in the provinces of Mendoza, San Juan, La Rioja, Catamarca, and Córdoba, is characterized by a blackening of the cortex, starting at or near soil-level and extending upwards to the secondary branches; at the same time the fungus proceeds to girdle the entire tree and also migrates inwards, even the central cylinder being sometimes involved. From the cankers formed on the surface of the affected cortex a gummy substance is exuded, which turns black on exposure to the air. The foliage of diseased trees becomes chlorotic and is largely shed before death ensues, two to three years after the onset of the attack.

Control may be effected by the excision of the decayed tissues and the application of mercuric chloride (1 in 1,000), mercuric cyanide (1 in 100), or formalin (1 in 9) to the cut surfaces, which should then be painted with Bordeaux paste (1–2–10) or a mixture of linseed oil and commercial Bordeaux, the latter being particularly recommended for its adhesiveness and resistance to weathering.

Wimbush (S. H.). **Canker on Monterey Cypress in Kenya.**—*Emp. For. J.*, xxiii, 1, p. 74, 1944.

Nine-year-old Monterey cypress (*Cupressus macrocarpa*) trees growing 40 miles east of Nairobi on the Iveti Hills were found to be dying from the tops downwards and to show a resinous exudation from cankers on the upper branches. The disease closely resembled the description of that produced on the same host in California by *Coryneum cardinale* [*R.A.M.*, xviii, p. 492; xix, p. 623], and R. M. Nattrass reported that the cankers were associated with a fungus similar to the Californian organism. Evidence obtained indicated that canker incidence was closely connected with soil depth, the disease having attacked only those trees whose roots had failed to develop properly owing to the shallowness of the soil overlying the parent rock formation. Other *Cupressus macrocarpa* trees, 12 to 14 years old and

growing very vigorously on the southern slopes of Mount Kenya, were also affected. In this case, the outbreak had followed damage by monkeys, who had barked the main stem.

It is considered that, while in both plantations the disease attacked trees already weakened by other causes, a serious view must be taken of the appearance of the canker in Kenya. All unthrifty and diseased trees have been cut out, and a strict watch is being kept on the affected plantations. Seed of species of *Cupressus* that appeared to show immunity in California has been planted, and at two years of age *C. sargentii*, *C. forbesii*, and *C. sargentii* [var.] *duttoni* are showing the best form and growth rate.

Martin (J. F.). **Ribes eradication effectively controls White Pine blister rust.**—*J. For.*, xlii, 4, pp. 255–260, 1 graph, 1944.

The blister rust fungus [*Cronartium ribicola*] is disseminated by wind-borne spores from pine to *Ribes* for distances up to or exceeding 300 miles, whereas from *Ribes* to pines the radius of infection does not ordinarily extend beyond 900 ft., though under favourable conditions the parasite may reach the trees from highly susceptible species, e.g., black currant and *R. bracteosum*, situated a mile or more away. In white pine forest areas the disease may be combated by reducing the currants to an average of 25 ft. or less of live stem per acre. Thus, in protected areas in New Hampshire, New York, and Pennsylvania in 1934 the number of pines infected out of a total of 8,635 before and after eradication were 2,824 and 33 (32·7 and 0·4 per cent.), respectively, and the total number of cankers amounted to 6,603, of which 6,515 (98·7 per cent.) originated before extirpation of the alternate host, and 88 (1·3 per cent.) after. In 1937, out of a total of 25,725 pines, 6,062 were infected before and 183 after eradication (23·6 and 0·7 per cent., respectively), and the numbers of cankers originating before and after removal of the currants were 7,784 and 293 (96·4 and 3·6 per cent., respectively). In unprotected areas in the same two years, the numbers of pines infected out of 11,927 and 21,582 were 6,311 and 6,687 (52·9 and 31 per cent., respectively), bearing 16,626 and 10,684 cankers, respectively. Similar results have been obtained in other parts of the country. In Wisconsin and Minnesota, for instance, in 1941, the diseased trees out of a total of 6,440 on 23 protected plots numbered 964, of which only 35 contracted infection after *Ribes* eradication, mostly carried out in 1936, a few areas, however, having been worked in other years between 1932 and 1938. Of the 1,531 cankers located on the trees, only 54 (3·5 per cent.) originated after the extirpation of the currants. A study in Idaho in 1934 of five areas protected from 1929 to 1931 showed that only 0·6 per cent. of the pines developed cankers after *Ribes* eradication, compared with 28 per cent. on four comparable areas left unprotected during the same period.

Protection of white pine is more complete when the alternate host is eradicated prior to invasion of the area by *C. ribicola*. Thus, in the Upper Priest River drainage of the Kaniksu National Forest, the initial protection of 1924–5 kept the trees free from blister rust until re-working was carried out in 1941–2. In the Fox Creek and Big Creek drainages of northern Idaho, which were logged from 1926 to 1928, vigorous pine stands arose from seedlings, while several hundred *Ribes* per acre appeared at the same time. In 1932 or 1933, blister rust spread to the two areas, in which eradication was undertaken in 1937. In 1941, a survey revealed 3·6 per cent. infection in Fox Creek and 49·5 per cent. in Big Creek, where the work was carried out too late in the season to confer adequate protection. Both areas have since been re-worked, and in Big Creek the additional precaution of pruning the infected limbs from the trees has been taken.

During the four-year period from 1933 to 1936, initial *Ribes* eradication was performed on 1,405,867 acres in the western white pine [*Pinus monticola*] region,

but since that time the scope of the control programme has not admitted of the planned schedule of re-workings. Steady progress, however, has been made, and some 1,000,000 acres are now under protection.

An important result of *Ribes* eradication, often overlooked, is the natural re-stocking of protected areas thereby permitted with seedlings that would otherwise have been killed by the rust. In pine stands of aesthetic or recreational importance, as well as in forest nurseries, specially thorough protection is required which must be ensured by periodical re-workings.

Buchanan (T. S.). **Effects of pruning young Western White Pine.**—*J. For.*, xlii, 5, pp. 365–366, 1944.

The results of a study in Idaho on the effects of pruning, carried out in such a way as to stimulate the probable action of blister rust (*Cronartium ribicola*) twig and branch cankers, on 14-year-old western white pine [*Pinus monticola*] indicated that multiple infections of this type are not directly concerned in the death of the trees. The operation caused a loss of increment proportional to its severity, the measurements being somewhat significant ($P = 0{\cdot}09$) in the case of trees deprived of 25 per cent. of their foliage, and highly so ($P < 0{\cdot}01$) where 50 or 75 per cent. was removed. From the silvicultural standpoint, this decrease of growth is of interest to blister rust control agencies in the west, where pruning to save diseased trees and reduce the spore supply is being practised in some young plantings and natural stands.

Littlefield (E. W.). **A plantation of Ponderosa Pine in northern New York.**—*J. For.*, xlii, 5, pp. 364–365, 1944.

Attention is drawn to a ¾-acre plantation of *Pinus ponderosa* trees in Clinton County, New York, which have successfully withstood exposure to *Cronartium comptoniae* [*R.A.M.*, xx, p. 614] during the 33 years since they were set out as transplants in 1911. The alternate host, sweetfern [*Comptonia peregrina*], abounds in adjacent fields. All the infections observed on the trees were within 8 ft. of the ground. A sample count on 58 showed one living infected tree and two killed by the rust. Evidently *Cronartium comptoniae* is a relatively weak parasite on trees that have passed the juvenile stage, unless local conditions are unfavourable for its development on older material.

Andersson (Y.). **Impregnering av träsilor med arsenik- och kopparhaltiga impregneringsmedel.** [Wooden silo preservation with arsenic- and copper-containing preservatives.]—*Landtmannen, Uppsala*, xxviii, 31, pp. 705 707, 1944.

The results of analyses made in connexion with experiments in the preservation of wooden silos in Sweden with arsenic (pressure and open-tank methods) [*R.A.M.*, xxi, p. 509] and copper (cuprinol) [ibid., xxii, p. 464] indicated that the latter can safely be used without the least risk of poisoning livestock by consumption of the stored fodder. In the case of arsenic, however, the danger of adverse effects on health, especially of poultry, is not altogether negligible, and it is recommended that the inner walls of silos thus treated should be painted with a tar or asphalt solution to prevent the leaching-out of the chemical from the wood.

Edwards (C. A.) & Walker (J.). **Preservatives for farm fence posts.**—*Sci. Agric.*, xxiv, 8, pp. 366–372, 3 figs., 1944.

Studies at the Dominion Forest Nursery Station, Indian Head, Saskatchewan, on the preservative treatment of fence posts (7 ft. long and 3 to 5½ in. in diameter, peeled and seasoned) [cf. *R.A.M.*, xxiii, p. 51] showed that with creosote the greatest durability resulted from setting the posts to a depth of 30 in. in creosote heated to a temperature of 200° to 230° F. for one hour, and allowing them to

cool off in the creosote for 10 hours. Slightly less good results followed treatment in a 5 per cent. solution of zinc chloride heated to 190° to 200° for one-half to one hour, followed by cooling in the solution for 36 hours. Creozol (Coderre's Special) was much less effective than creosote. Copper sulphate (18 to 36 in. immersion for 12 hours) in a saturated solution (containing 2½ to 3 lb. bluestone per gal. cold water) appeared greatly to increase the durability of green cut poplar posts.

The average durability of untreated tamarack [*Larix laricina*] and cedar posts was slightly less than that of posts of different species subjected to the most effective chemical treatments.

Groves (J. W.) & Skolko (A. J.). **Notes on seed-borne fungi I. Stemphylium.**—*Canad. J. Res.*, Sect. C, xxii, 4, pp. 190–199, 5 pl., 1944.

In examining agricultural seed received at Ottawa, mainly from the Plant Products Division and the Canadian Seed Growers' Association, the authors isolated (from samples of 100 seeds, surface-sterilized, placed in Petri dishes on 2 per cent. malt extract agar, and stored at room temperature for ten days) the following fungi: *Stemphylium botryosum* (the imperfect stage of *Pleospora herbarum*) from seed of onion, leek, celery, asparagus, beet, Swiss chard (*Beta vulgaris* var. *cicla*), cabbage, turnip, pumpkin, carrot, red fescue (*Festuca rubra*), lettuce, flax, lucerne, parsnip, parsley, scarlet runner bean, timothy, pea, radish, rye, millet (*Setaria italica*), spinach, red clover, wheat, and broad bean (*Vicia faba*); *Stemphylium sarciniforme* only from clover seed; and *Macrosporium consortiale* Thüm., renamed *S. consortiale* (Thüm.) n. comb., from onion, celery, beet, Swiss chard, broccoli, cauliflower, cabbage, squash, pumpkin, carrot, lettuce, tomato, lucerne, parsnip, parsley, scarlet runner bean, bean, pea (most frequently on seed from Alberta and British Columbia, but not confined to the western provinces), radish, spinach, *Taraxacum kok-saghyz* imported from the U.S.S.R., and broad bean. Probable synonyms of *S. consortiale* are *S. verruculosum* (Zimmerm.) Sacc. and *S. congestum* Newton [*R.A.M.*, vii, pp. 363, 789].

Snyder (W. C.) & Baker (K. F.). **Diseases of seed Cabbage in California.**—*Plant Dis. Reptr*, xxvii, 18, pp. 394–398, 1943. [Mimeographed.]

A survey of the seed-cabbage fields of California in 1942–3, in the course of which over 90 per cent. of the cabbage seed acreage of the State was inspected, showed that the most important diseases of the crop were absent. Downy mildew (*Peronospora parasitica*) was of no importance. Leaf spots due to *Alternaria brassicae* and *A. circinans* [*A. oleracea*] were insignificant. Ring spot (*Mycosphaerella brassicicola*) was rare except in occasional very small patches of the locally-grown Colma cabbage which growers had allowed to go to seed for their own use or to sell to neighbours. Circumstantial evidence strongly suggested that ring spot is seed-borne. A leaf spot due to a species of *Cercospora* was observed, apparently for the first time on cabbage grown in California. Very slight infection by powdery mildew (*Erysiphe polygoni*) was noted on the lowest leaves of scattered plants. An occasional head showing drop (*Sclerotinia sclerotiorum*) was found in three or four fields, and infection of the seed stalks, producing white blight, occurred in three fields. A few plants with black ring virus [ring spot: *R.A.M.*, xvii, p. 151] were found in one field and aster yellows was occasionally present.

Of the diseases searched for but not found, black rot and black leg [*Xanthomonas campestris* and *Phoma lingam*, respectively], were the most important. The latter has not yet been reported from California. Records on market cabbages in recent years are summarized.

It is concluded that cabbage-growers should look well to their seed source and practise consistently both plant-bed and crop rotation.

Ayers (G. W.). **Studies on the life history of the club root organism, Plasmodiophora brassicae.**—*Canad. J. Res.*, Sect. C, xxii, 4, pp. 143–149, 27 figs., 1944.

This is a progress report on a study of *Plasmodiophora brassicae* [*R.A.M.*, xxiii, p. 283] carried out at Ottawa and Charlottetown, Canada, from 1940 to 1942. Resting spores of the fungus, obtained from thoroughly clubbed plant tissue which had been broken down by secondary invaders, were found to germinate well in tap water at room temperature in one to ten days, depending on the maturity of the spores. Frost appeared to hasten germination, but was not essential to it. The zoospores from resting spores are biflagellate and heterokont (with one short and one long flagellum) and vary greatly in size, being 2·8 to 5·9 μ in diameter. This variation in size is taken to indicate that growth of the zoospores takes place after their emergence from the resting spores, which are 2·8 to 3·8 μ in diameter. At no time was fusion of the zoospores observed. When a released zoospore comes in contact with root hairs or epidermal root cells of cruciferous seedlings, it settles down as an amoeba and penetrates the cell wall of the host to form a young thallus inside the cell. When multiple infection occurs in a single root hair, the separate thalli show no tendency to fuse. The thallus may or may not become greatly enlarged before cleavage of the protoplasm takes place to form irregular zoosporangial clusters. Each zoosporangium contains four to eight zoospores, which, at maturity, are discharged through small openings at the point of contact of the zoosporangium with the cell wall of the root hair, provided free moisture is present. Under adverse conditions, the protoplasm of the thallus has been observed to disintegrate. Depending upon conditions of moisture and temperature, from two to eight days (four to six at ordinary field temperatures of 62° to 70° F.) are required from infection of the host to the discharge of zoospores from the zoosporangium. Those zoospores constitute the second motile phase in the life-history of the fungus; they are biflagellate and heterokont, and except for their uniformly smaller size, 1·9 to 2·3 μ in diameter, indistinguishable from those arising from the resting spores. Whether or not the zoospores from zoosporangia increase in size after discharge has not been determined, nor is anything known of their subsequent role.

In controlled laboratory experiments, the minimum temperature limit for infection of the root hairs of swede seedlings by *P. brassicae* was found to be between 54° and 57°, the optimum at about 70°, and the maximum above 92°. The incubation period was progressively shortened with increase of temperature from 8 days at 56° to 58° to 2 or 2½ days at 90° to 92°, although conditions became less favourable for infection at the higher temperatures.

Esau (Katherine). **Anatomical and cytological studies on Beet mosaic.**—*J. agric. Res.*, lxix, 3, pp. 95–117, 7 pl., 6 figs., 1944.

In this study of sugar beet mosaic [*R.A.M.*, xv, p. 549] conducted in California, examination of outdoor and greenhouse plants with systemic symptoms of the disease showed no degeneration and no foreign or abnormal bodies in the phloem, indicating that the mosaic virus is less intimately related to the phloem than is the curly-top virus.

In the mottled leaves of diseased plants, the yellow areas tended to be thinner than the green areas and showed certain juvenile characteristics, such as nearly isodiametric and rather closely packed cells with no typical differentiation into palisade and spongy layers. In the early stages of development, the yellow areas showed scanty cell division while the green areas continued to divide actively or even at abnormally high rates, and accordingly resemble healthy mesophyll or appear hyperplastic at maturity. In the early stages, therefore, the yellow areas with their larger cells appeared more mature than the green ones with their

numerous but smaller cells; later, however, when the green areas had matured, the yellow ones appeared as under-developed portions of the leaf. The degree of difference between the yellow and the green areas and between the diseased and healthy leaves was found to vary considerably.

The chloroplasts of the yellow areas were observed to undergo pathological changes of different degrees: in young cells they were deficient in number, possibly owing to delayed development or destruction of plastic primordia; in older cells they were pale and fragile and readily swelled and disintegrated when brought in contact with tap water. In some cases the chloroplasts were diffuse and irregular in shape, and stained lightly. In the most severely diseased cells, from which nuclei may be absent, the chloroplasts tended to fuse into amorphous masses. It is concluded that these degenerative phenomena, which are similar to others induced by many different injurious agents, are symptoms of physiological disturbances caused within the diseased cell by the presence of the virus but are not necessarily responses to any specific action of the virus.

Björling (K.). **Några svampsjukdomar på Raps och Vitsenap.** [Some fungous diseases of Colza and White Mustard.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, viii, 5, pp. 73–77, 11 figs., 1944.

Of recent years the acreage of oil-producing crops, notably colza and white mustard, has been widely extended in the south of Sweden, and in this connexion notes are given on the diseases caused by *Peronospora brassicae*, *Alternaria brassicae*, *Cercosporella brassicae*, and *Plasmodiophora brassicae*, of which the two first-named are the most prevalent.

Leach (L. D.) & Holland (A. H.). **Seed treatment of large Lima Beans in California.**—*Plant Dis. Reptr*, xxvii, 20, pp. 498–500, 1943. [Mimeographed.]

The average numbers of large Lima bean [*Phaseolus lunatus*] plants of four varieties emerging from 100 ft. of row in 11 fields in Ventura County, California, in 1943 from (*a*) untreated and (*b*) seed treated with spergon (0·25 per cent.) against *Pythium ultimum* and *Rhizoctonia* [*Corticium*] *solani*, sown at an average rate of 87 lb. per acre were, respectively, 109 and 146 [*R.A.M.*, xxiii, p. 371]. During the same year some 13,000 acres were planted with treated Lima bean seed in the region under observation, compared with 1,500 and under 20 in 1942 and 1941, respectively.

Heinze (K.). **Die Feldbereinigungen bei Sojakulturen als Schutzmassnahme gegen die Ausbreitung des virösen Sojamosaiks. Vorl. Mitt.** [Field sanitation in Soy-bean plantings as a prophylactic measure against the spread of the Soy-bean mosaic virus. Preliminary note.]—*Züchter*, xiv, pp. 254–258, 1942. [Abs. in *Gartenbauwiss.* (Ref.), xviii, 1, p. 23, 1943.]

The most destructive disease of soy-beans, especially of the yellow varieties, in Germany is mosaic [*R.A.M.*, xxii, p. 90], which necessitates stringent field sanitation to prevent the perpetuation of the virus by the seed of infected plants. This mode of control involves repeated inspections, which were undertaken by the writer [? in 1942] in three experimental fields, at the Biological Institute, Dahlem, Berlin, near Vienna, and in the Warthe District. The first count, four to five weeks after sowing, revealed an incidence of 23 per cent. diseased plants, which rose sharply during the summer owing to the exceptional prevalence of aphids. There was a marked difference between the plots from which the infected plants had been eliminated and the untreated controls. Investigations are in progress to determine whether late-season infections involve the seed. Soy-bean mosaic appears to be more widespread in eastern Germany than in other parts of the country.

Walker (J. C.), Jones (H. A.), & Clarke (A. E.). **Smut resistance in an Allium species hybrid.**—*J. agric. Res.*, lxix, 1, pp. 1–8, 1944.

Since Jones and Clarke obtained a fertile amphidiploid from a cross between *Allium fistulosum* and the onion (*J. Hered.*, xxxiii, pp. 25–32, 1942), the former is a source of resistance to onion smut (*Urocystis cepulae*) [*R.A.M.*, xxii, p. 6] capable of being incorporated into commercial onion varieties by breeding.

In 1936–7, 1,844 plants of the Nebuka strain of *A. fistulosum* [ibid., xii, p. 416] were tested for resistance, and only 111 or 6 per cent. developed lesions, all of which were above the crotch, where they did little injury, the attacked seedlings being able to survive. Of the three onion varieties grown as controls, Ebenezer showed 86·4 per cent. diseased, Sweet Spanish 73·2, and Early Grano 68·5. In 1938–9, Nebuka again proved highly resistant, only 0·9 per cent. developing lesions below the crotch, as against 74·9 per cent. for seven onion varieties. The hybrids between onion and Nebuka also showed considerable resistance, only 13·7 per cent. of these plants developing lesions below the crotch.

In 1939–40, the percentages of seedlings developing lesions below the crotch were 0·6, 61·2, and 8·7 for Nebuka, onion, and their F_1 hybrids, respectively. The F_1 hybrids were self-sterile so that no F_2 populations were obtained. The first and second back-cross generations to *A. cepa* were as severely infected as the original commercial varieties used in the crosses.

In the 1941–2 tests, Nebuka had 0·5 per cent. plants with lesions below the crotch, as against 81·3 per cent. for Yellow Globe Danvers onion and 82·1 per cent. for the back-cross populations.

In 1941, two populations of the fertile amphidiploid, obtained from a cross between Australian brown onion and Nebuka, were tested. One was a P_2 population obtained by selfing the original amphidiploid, while the other was a mixture of P_3 progenies from these plants. None of the Nebuka plants smutted below the crotch, though 98·8 per cent. of Yellow Globe Danvers became infected. The amphidiploid was intermediate in its reaction, 38 per cent. of the P_2 and 59·1 of the P_3 populations becoming infected below the crotch. The partial resistance of the amphidiploid was confirmed by a later test. Since back-crossing has not so far been very successful it may be that the utilization of the fertile amphidiploid will prove more satisfactory.

Tims (E. C.). **Some diseases of Onions grown for seed in Louisiana.**—*Plant Dis. Reptr*, xxviii, 19, pp. 633–634, 1944. [Mimeographed.]

The limiting factor in the growing of onion seed in the southern part of Louisiana is stated to be the occurrence of stalk rot diseases: mildew (*Peronospora destructor*) [*R.A.M.*, xxii, p. 336], purple blotch (*Macrosporium* [*Alternaria*] *porri*) [ibid., xvii, p. 654], and black stalk rot (*M. parasiticum*) [*Pleospora herbarum*: ibid., xxiii, p. 208], all of which develop chiefly during blossoming and seed-setting time. In addition, a serious root rot, often associated with pink root (*Phoma terrestris*) [ibid., xxi, p. 117], was observed in some fields during the past season causing a dying-off of the seed stalks. The stalk-rot diseases often overlap and may all occur on the same seed stalk. The most serious disease among them is considered to be mildew which, in 1943, almost destroyed the onions in certain areas of the State. A blasting of the seed heads, of obscure etiology, is a serious problem in certain seasons and caused losses of 40 to 50 per cent. in one or two fields in 1944. Many strong seed stalks produced practically no seed.

Hooker (W. J.). **Comparative studies of two Carrot leaf diseases.**—*Phytopathology*, xxxiv, 6, pp. 606–612, 1 fig., 1 graph, 1944.

Differences in the seasonal cycles of two carrot leaf diseases caused, respectively, by *Cercospora carotae* and *Macrosporium carotae* [*R.A.M.*, xxiii, p. 420],

have been observed in Wisconsin and reported from Massachusetts [ibid., viii, p. 352]. Studies were accordingly carried out in the former State to determine whether the variations in prevalence of the two pathogens, *C. carotae* being rife in July and early August and *M. carotae* reaching a climax during August and throughout September, were explicable on the basis of differential reactions to temperature and leaf age.

The spores of both organisms germinated over a wide temperature range, with an optimum in each case at 28° C. At 16° the progress of infection by both fungi was retarded, while with rising temperatures up to 24° it was accelerated [loc. cit.: see also ibid., xxii, p. 286]. Temperature, therefore, is evidently not the decisive factor in the early development of *C. carotae* and the late appearance of *M. carotae*. On the other hand, there was a striking contrast between the two fungi in respect of preference for young or old foliage, *C. carotae* predominating on the former and *M. carotae* on the latter. These divergences in the host-parasite relations are thought to be largely accountable for the above-mentioned seasonal differences in the development of the two diseases under observation.

MAIER (W.). **Eine Bormangelkrankheit des Sellerie (Apium graveolens L. var. rapaceum (Mill.) DC.).** [A boron deficiency disease of Celeriac (*Apium graveolens* L. var. *rapaceum* (Mill.) DC.).]—*Gartenbauwiss.*, xviii, 1, pp. 47–58, 10 figs., 1943.

The author's studies on a boron deficiency disease of celeriac [*R.A.M.*, xxii, pp. 111, 192], hitherto unknown in Germany, at the Geisenheim (Rhine) Horticultural Experiment Station are fully described. The symptoms of the disorder, which affects the leaves, rootstocks, and roots, are in general agreement with those already reported in connexion with beet heart and dry rot [ibid., xi, p. 147 *et passim*]; they were reproduced in water culture experiments in plants deprived of boron in the nutrient solution. The trouble is responsible for heavy reductions in the crop owing to the small size of the rootstocks and their intersection by necrotic tissue. In one test the rootstock and leaf yields were increased 3 and 3½ times, respectively, by the application to the soil of 4 gm. borax per sq. m., a further advantage of the treatment lying in the pure white flesh of the perfectly sound rootstocks. Analyses of the 1942 crop from two localities revealed a lower boron content in the diseased than in the healthy plants, the most striking disparities occurring in the foliage.

THOMPSON (R. C.). **Reaction of Lactuca species to the Aster yellows virus under field conditions.**—*J. agric. Res.*, lxix, 3, pp. 119–125, 1944.

The losses caused by the aster yellows virus to lettuce crops [*R.A.M.*, xxii, p. 382] in certain localities in the eastern part of the United States are stated to amount to as much as 30 per cent. in some seasons, the disease growing increasingly more serious. In field trials initiated in 1935 at the Bureau of Plant Industry Station at Beltsville, Maryland, none of the 200 varieties and strains of cultivated lettuce showed any degree of resistance to the virus, while among the 22 wild species and strains of *Lactuca* tested, only two strains of *L. serriola* and two of *L. saligna* gave promise of value in breeding work, as they both showed marked ability to escape infection and crossed readily with cultivated lettuce. *L. tatarica*, *L. bourgaei*, and *L. marschallii* appeared to be immune from the virus, and the 17-chromosome species (*L. canadensis*, *L. spicata*, *L. graminifolia*, and *L. floridana*) as a group indicated some resistance, but all of these are genetically incompatible with the cultivated form and therefore valueless for breeding. *L. virosa* and *L. squarrosa* were highly susceptible.

Forsberg (J. L.), Olson (E.), & Binkley (A. M.). **Experiments with Pea seed treatments in Colorado.**—*Phytopathology*, xxxiv, 8, pp. 753–759, 1944.

A tabulated survey is given of experiments in the disinfection of pea seed of the Alaska, Perfection, Wisconsin Sweet, Green Admiral, Little Marvel, and Rogers' 95 varieties in northern Colorado and the San Luis and Arkansas Valleys with new improved ceresan (1 oz. per bush.), spergon, arasan, and yellow cuprocide (all at 2 oz.) [*R.A.M.*, xxiii, p. 511]. The root-rotting fungi concerned in the stand reductions against which the treatments were directed included *Fusarium solani* var. *martii* f. 2 (the most prevalent), *Ascochyta pinodella*, *Pythium* sp., and *Corticium vagum* var. *solani* (*Rhizoctonia solani*) [*C. solani*]. All the preparations increased emergence, spergon and new improved ceresan leading in most of the tests, but pending further studies on the factors governing their efficacy, no specific recommendations in favour of any of the four are made at this juncture.

Hedges (Florence). **Association of Xanthomonas phaseoli and the common Bean-mosaic virus, Marmor phaseoli. I. Effect on pathogenicity of the seed-borne infective agents.**—*Phytopathology*, xxxiv, 7, pp. 662–693, 2 figs., 1944.

A full account is given of the writer's exhaustive studies at the Plant Industry Station, Beltsville, Maryland, on the effect of the association of *Xanthomonas phaseoli* and the bean mosaic virus on the pathogenicity of these two seed-borne organisms. The discovery of the connexion was originally made by W. J. Zaumeyer in the course of tests for mosaic resistance on a bean hybrid, later known as US. No. 5 Refugee, on the primary leaves of which, rubbed with the expressed juice of mosaic-infected trifoliate bean leaves, extensive typical lesions of *X. phaseoli* developed. The writer found virulent *X. phaseoli* and a less pathogenic yellow variant of the same occurring in a masked form in trifoliate bean leaves showing only common mosaic symptoms.

In one experiment, in which Stringless Green Refugee was inoculated with single-colony cultures of two bacterial isolates, viz., 'typical' *X. phaseoli* from the lesions on primary leaves and its variant masked in the trifoliate leaves, 75 per cent. typical mosaic developed, the bacteria apparently acting as carriers of the virus. The 'typical' *X. phaseoli* produced 100 per cent. bacterial infection on the same Stringless Green Refugee plants and also on the mosaic-immune Corbett Refugee, while the mildly pathogenic variant attacked the latter variety only. The 'typical' *X. phaseoli* retained its apparent capacity to cause mosaic for at least six weeks in stock cultures on steamed potato cylinders, held for about a fortnight of this period at laboratory temperatures. All published records denote that one to two days is the limit of longevity of the bean mosaic virus in expressed juice at room temperatures. The yellow variant, after losing its apparent initial ability to produce mosaic, was able to cause bacterial blight of the hitherto immune Stringless Green Refugee.

Serial passages of juice containing both pathogens revealed the dominance of the virus and a marked increase in the incidence and severity of mosaic infection. With the 38th consecutive passage, 100 per cent. extreme dwarfing and bunching was accompanied by the reduction of most of the trifoliate leaves to a minute filiform state consisting of barely more than the midribs. This ultra-virulent form of mosaic persisted throughout the remainder of the 50 or so passages comprised in the trials. Acute derangement of the metabolism was expressed by the striking discoloration and prominent veining of the primary leaves, and of the large trifoliate ones (if any). Only a few plants produced flowers.

Bacterial symptoms in the serial passages were in general somewhat inconspicuous, and disappeared abruptly just before the sudden onset of the ultra-severe form of mosaic. They recurred on the inoculated primary leaves only after ten serial

passages. Virulent isolates of apparently 'typical' *X. phaseoli* were readily obtained from the serial passages as long as the symptoms were manifest, but after their disappearance colonies of a smooth (S), opaque, white, mildly pathogenic form developed in increasing numbers on the plates, while smooth, pink colonies were also produced sporadically. Subsequent studies, intended for future publication, showed both these forms to be variants of the virulent *X. phaseoli*. An occasional set of plates contained colonies of *X. phaseoli* which were dissociating in a remarkable manner into S white and S yellow. The aberrant forms ranged from S yellow colonies with S white, marginal, fan-shaped out-thrusts to those in which the entire periphery was S white, while the S yellow component was reduced to a central area resembling a three- or four-petalled flower.

JONES (L. H.). **Relations of weather conditions to Onion blast.**—*Plant Physiol.*, xix, 1, pp. 139–147, 1 fig., 1 diag., 1944.

'Blast', a physiological disease of onion leaves of the sun-scald type, is attributed to the inability of the plant rapidly to adjust itself to a combination of bright sunshine, high temperature, and low relative humidity following a period of cloudy, wet weather accompanied by high temperature and high relative humidity. Under these conditions the leaves turn white from the tips downwards in a few hours, or in milder cases develop a white spotting round the stomata which gradually expands as the leaf dies back from the apex. Considerable damage ensues if fine weather persists, but a recurrence of cloud may assist the plants, which are characterized by an excess of soft tissue and an abnormally small root system, to maintain an equilibrium between the amount of water absorbed and that lost through transpiration. The extent and severity of the disease are dependent on the reciprocal intensity of the two environments and on the stage of development of the crop.

Field observations in Massachusetts, where 'blast' was serious in seven years between 1925 and 1940, viz., 1927, 1928, 1931, 1935, 1937, 1938, and 1940, were supplemented and confirmed by laboratory tests in which the disorder was produced at will by simulated environmental combinations. The latter could be illustrated by means of a specially devised apparatus of superimposed dials, each adjustable according to the particular weather factor represented.

DARLINGTON (C. D.). **Paracrinkle virus and inheritance.**—*Nature, Lond.*, cliv, 3911, p. 489, 1944.

This is the author's reply to the criticism made by Carson and his co-workers [*R.A.M.*, xxiii, p. 472] of his paper on virus and plasmagenes [loc. cit.].

Service and regulatory announcements, April to June, 1944. Announcement relating to flag smut quarantine (No. 59).—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, pp. 33–35, 1944.

A temporary national shortage of foodstuffs and rail transport facilities in the United States has necessitated the importation of wheat from Australia, the existing prohibition against which under quarantine No. 59 on account of flag smut [*Urocystis tritici*: *R.A.M.*, v, p. 320] is modified by the present amendment, dated 9th June, 1944, to permit the entry through the port of Los Angeles of a quantity not exceeding six boatloads before 30th November, 1944, from the southern part of the country, where the disease does not appear to have been reported since 1941. The imported wheat is to be used solely as fodder and limited to an area of southern California where the crop is not of economic importance.